EXECUTIVE SUMMARY

Thiagarajar College of Engineering (TCE), energy audit team conducted a Detailed Energy Audit at St. Mary's College (Autonomous), Thoothukudi on 21st & 22nd June 2023. The list of Energy auditors is enclosed as **Annexure A**.

The methodology adopted for conducting the detailed energy audit are basic data collection, measurement at major electrical energy consuming equipment and analysis of data collected and identification of specific energy saving proposals.

TCE energy team and St. Mary's team have together identified an annual energy saving potential of **Rs. 2,31,000/-** based on present energy cost.

The summary of annual savings identified is as below:

a)	Annual savings without investment (2 proposals)	:	**Rs. 49000/-**
b)	Annual savings with investment (2 proposals)	:	**Rs. 182000/-**
c)	Total Annual Savings (4 proposals)	:	**Rs. 231000/-**
d)	Investment Required	:	**Rs. 318000/-**
e)	Average payback period for capital proposals	:	**21 Months**

SPECIFIC ACTION PLAN

a) St. Mary's College (Autonomous), Thoothukudi, should identify specific person or department to implement the above proposals.
b) Specific target date for implementation of proposals should be made within 30 days of submission of this report.

c) St. Mary's College (Autonomous), Thoothukudi, should prioritize the above proposals and implement them in a phased manner.

d) In our opinion all the proposals can be implemented within one year, straightaway and should be on top priority.

e) St. Mary's College (Autonomous), Thoothukudi, should form an energy committee. The Secretary should head the committee. The committee should meet once in Three months and review the progress of implementation activity and identify new areas for energy conservation.

ACKNOWLEDGEMENT

TCE acknowledges with thanks for the cooperation and hospitality extended to the TCE energy audit team, during their detailed energy audit study at St. Mary's College (Autonomous), Thoothukudi. We appreciate the management for their commitment and focus given to the energy conservation towards improving economy.

We would like to place on record our sincere thanks to Dr. Sr. C. Shibana, Secretary, Dr. Sr. Jessie Fernando, Principal and Management of St. Mary's College (Autonomous), Thoothukudi for entrusting the Energy Audit work with us.

We express our thanks and appreciation for the following executives and staff members of St. Mary's College (Autonomous), Thoothukudi.

1. Dr. B. Serena Margaret - IQAC Coordinator
2. Mr. A.Antony Loyala - Laboratory Assistant
3. Mr. C.Ans Kumar - Electrical / Plumbing Worker

CHAPTER I

INTRODUCTION

St. Mary's College (Autonomous), Thoothukudi evinced interest in availing the services of Thiagarajar College of Engineering (TCE), Madurai for conducting a Detailed Energy Audit at their College premises. Further to that, TCE – Energy Management Cell submitted a proposal to conduct a Detailed Energy Audit.

The TCE proposal for conducting Detailed energy Audit was accepted by St. Mary's College (Autonomous), Thoothukudi. This report on Detailed Energy Audit study conducted at St. Mary's College (Autonomous), Thoothukudi, is in accordance with TCE's proposal agreed by St. Mary's College (Autonomous), Thoothukudi.

The methodology adopted for conducting the Detailed Energy Audit at St. Mary's College (Autonomous), Thoothukudi is as follows:

- Basic data collection on list of power consuming equipment, production capacities of the major equipment and operating parameters
- Power measurements of major electrical energy equipment
- Measurement of operating parameters of various equipment to estimate their operating efficiency
- Analysis of data collected and measurements to develop specific energy saving proposals
- Discussion with the St. Mary's College personnel on the identified proposals

An awareness programme was also conducted on 22nd June 2023 for the staff members and students of St. Mary's College, Thoothukudi at the campus to save energy.

We are pleased to mention that all the identified energy saving proposals has been discussed with St. Mary's College (Autonomous), Thoothukudi operating and maintenance executives concerned before finalizing the ideas.

A discussion on the findings of detailed energy audit at St. Mary's College (Autonomous), Thoothukudi, was presented to the Institution personnel on 22nd June 2023.The contents of the report are based on the data provided by St. Mary's College (Autonomous), Thoothukudi, during the detailed energy audit.

CHAPTER II

LIST OF ENERGY SAVING PROPOSALS

Sl No	Energy Saving Proposals	Annual Savings (Rs,)	Investment (Rs.)	Payback (Period In Months)
1	Replace Conventional Tube Lights with Energy Efficient LED Tube Lights	158000	143000	11
2	Replace Conventional Ceiling Fan with Energy Efficient BLDC Ceiling Fan	24000	175000	87
3	Switch off Offline UPS Systems, While closing the Laboratory	39000	-	-
4	Remove Stabilizer for Inverter Based Refrigerators	10000	-	-
	Total	**231000**	**318000**	**21**

CHAPTER III

ENERGY CONSUMPTION PATTERN

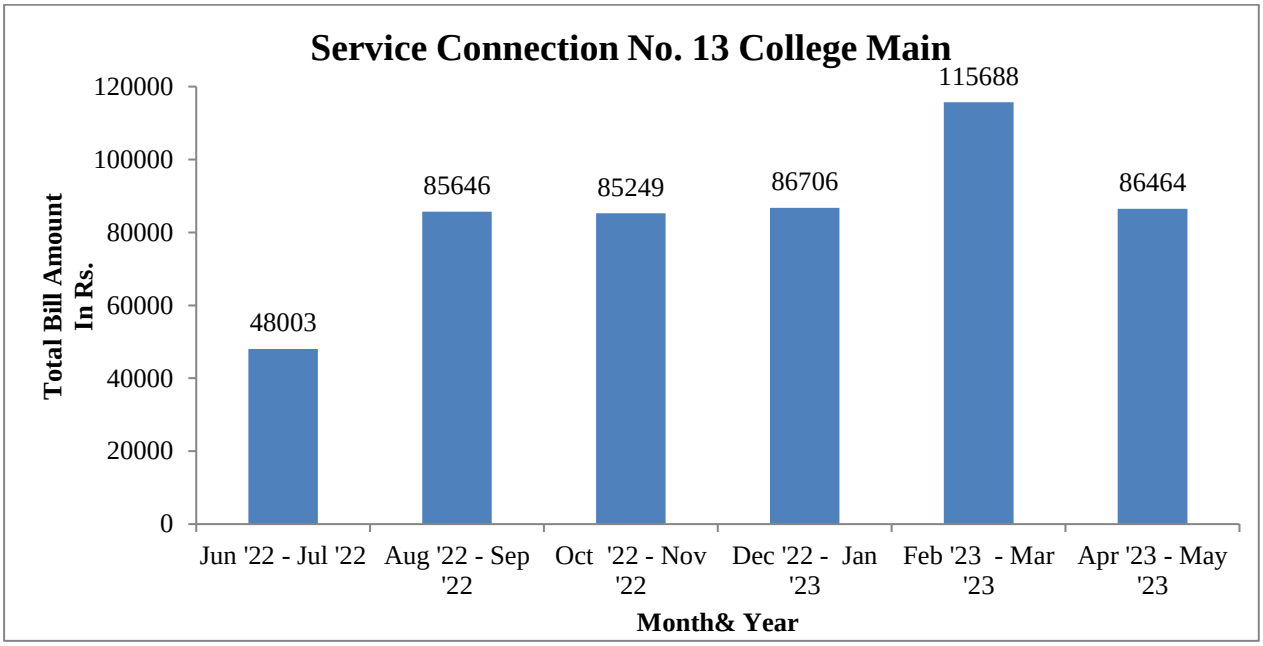
Summary of Energy Consumption

St. Mary's College (Autonomous), Thoothukudi availed 8 Nos. of Low Tension Power Supply from Tamilnadu Electricity Board for their Energy requirements. The Energy Consumption for the last 12 Months are highlighted in the following table :

Service Connection No. 13 College Main Supply

Connected Load – 48KW **Tariff : LM2B1**

Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2022	6370	36628	7771	48003	5.75	7.54
August & September 2022	9800	69534	12116	85646	5.75	8.74
October & November2022	8090	67956	13178	85249	8.00	10.54
December2022 & January2023	8270	69468	13373	86706	8.00	10.48
February & March 2023	11500	96600	14790	115688	8.00	10.06
April & May 2023	8190	68796	13220	86464	8.00	10.56
Academic Year 2022-2023	**52220**	**408982**	**74448**	**507756**	**8.00**	**9.72**



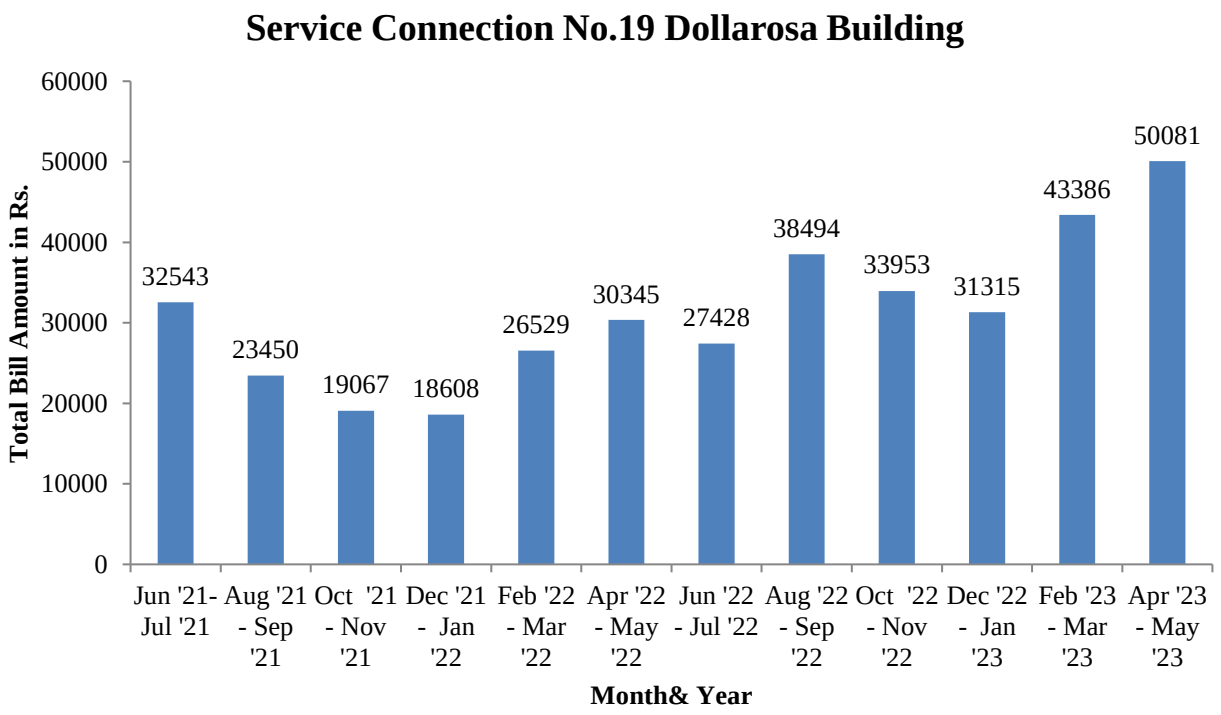
The College Energy bill was analyzed on the aspect of minimizing the penalty for excess demand and for low Power Factor. In all the LT Power Supply the penalty for Low power factor is Nil. There are few incidences there is a penalty for excess demand. Hope the proposed implementation of the Energy saving project will bring the demand under control in the near future.

Service Connection No. 19 Dollarosa Building

Connected Load – 39KW **Tariff : LM2B1**

Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2021	3800	21850	10693	32543	5.75	8.56
August & September 2021	3090	17768	5682	23450	5.75	7.59
October & November 2021	2360	13570	5497	19067	5.75	8.08
December 2021 & January 2022	2290	13168	5440	18608	5.75	8.13
February & March 2022	3600	20700	5829	26529	5.75	7.37
April & May 2022	4230	24323	6022	30345	5.75	7.17

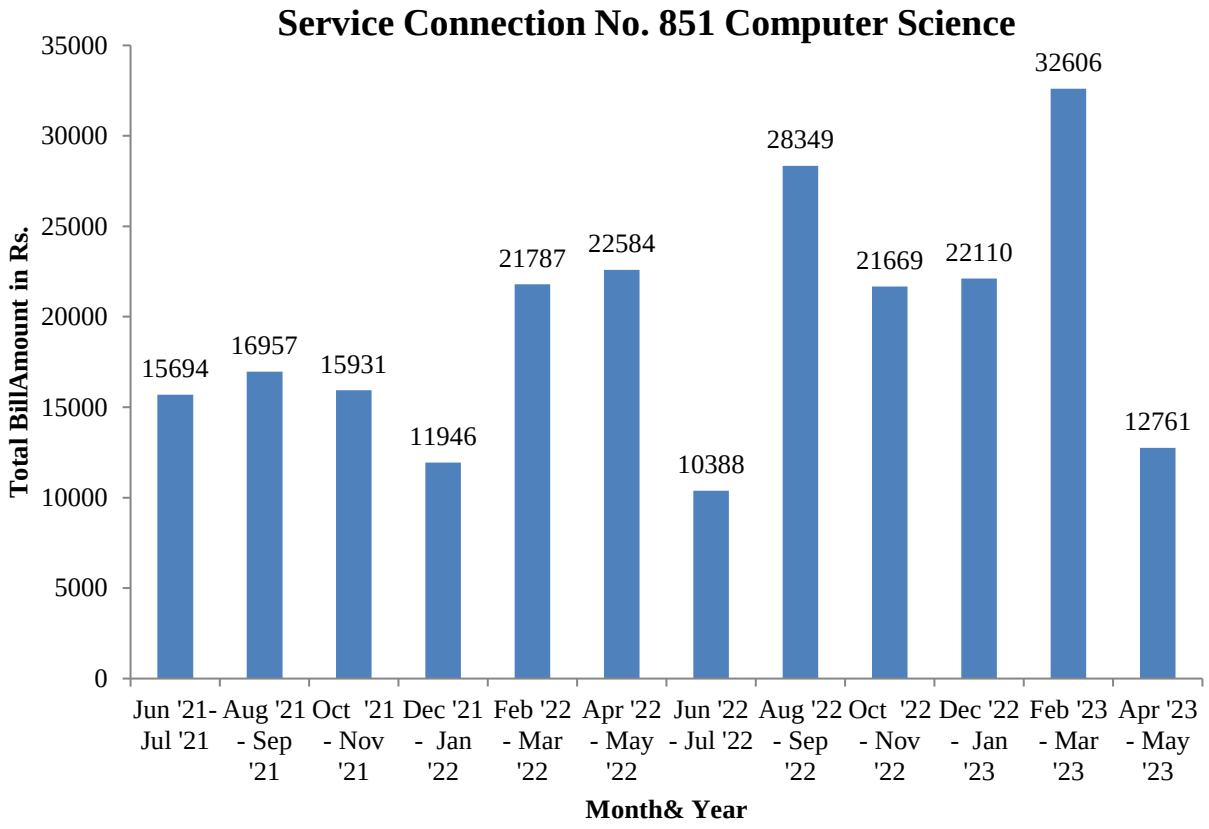
Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
Academic Year 2021-2022	**19370**	**111379**	**39163**	**150542**	**5.75**	**7.77**
June & July 2022	3740	21505	5923	27428	5.75	7.33
August & September 2022	4220	29941	8553	38494	5.75	9.12
October & November2022	2930	24612	9341	33953	8.00	11.59
December2022 & January2023	2640	22176	9139	31315	8.00	11.86
February & March 2023	4020	33768	9618	43386	8.00	10.79
April & May 2023	4770	40068	10013	50081	8.00	10.50
Academic Year 2022-2023	**22320**	**172070**	**52587**	**224657**	**8.00**	**10.07**



Service Connection No. 851 Computer Science Block

Connected Load – 26 KW **Tariff : LM2B1**

Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July2021	1530	8798	6896	15694	5.75	10.26
August & September 2021	2270	13053	3905	16957	5.75	7.47
October & November 2021	2100	12075	3856	15931	5.75	7.59
December 2021 & January 2022	1440	8280	3666	11946	5.75	8.30
February & March 2022	3070	17653	4135	21787	5.75	7.10
April & May 2022	3200	18400	4184	22584	5.75	7.06
Academic Year 2021-2022	**13610**	**78259**	**26642**	**104899**	**5.75**	**7.71**
June & July 2022	1180	6785	3603	10388	5.75	8.80
August & September 2022	3170	22491	5857	28349	5.75	8.94
October & November2022	1840	15456	6213	21669	8.00	11.78
December2022 & January2023	1890	15876	6234	22110	8.00	11.70
February & March 2023	3080	25872	6734	32606	8.00	10.59
April & May 2023	830	6972	5789	12761	8.00	15.37
Academic Year 2022-2023	**11990**	**93452**	**34430**	**127883**	**8.00**	**10.67**

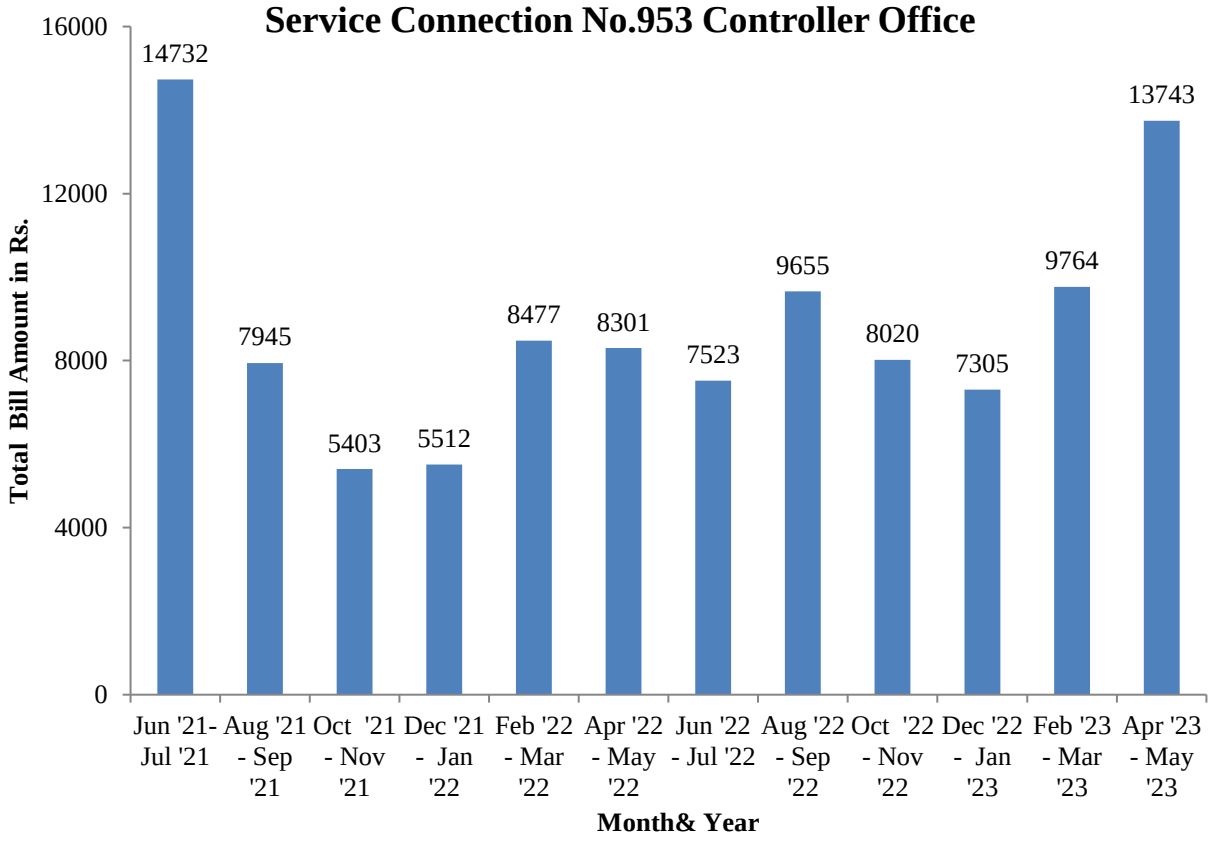


Service Connection No. 953 Controller Office

Connected Load – 8 KW **Tariff : LM2B1**

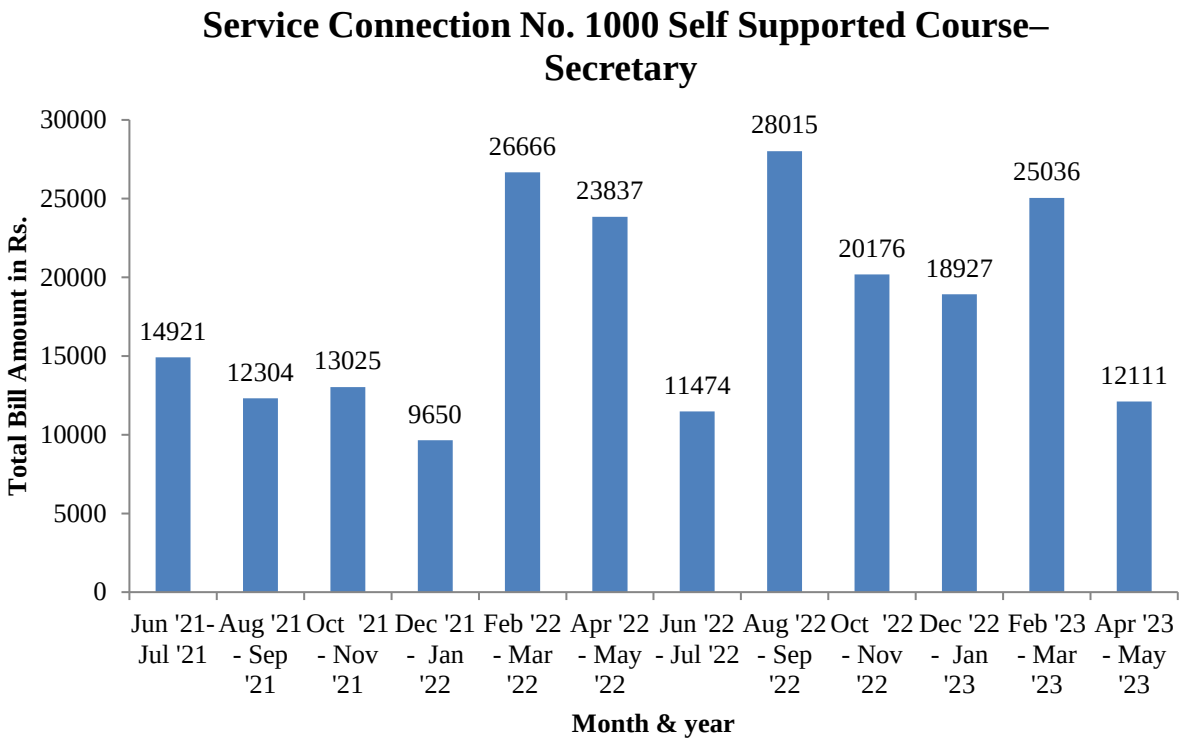
Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2021	2110	12133	2599	14732	5.75	6.98
August & September 2021	1150	6613	1333	7945	5.75	6.91
October & November 2021	730	4198	1206	5403	5.75	7.40
December 2021 & January 2022	750	4313	1200	5512	5.75	7.35
February & March 2022	1240	7130	1347	8477	5.75	6.84
April & May 2022	1210	6958	1344	8301	5.75	6.86
Academic Year 2021-2022	**7190**	**41345**	**9029**	**50370**	**5.75**	**7.01**

Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2022	1080	6210	1313	7523	5.75	6.97
August & September 2022	1100	7851	1804	9655	5.75	8.78
October & November2022	720	6048	1972	8020	8.00	11.14
December2022 & January2023	640	5376	1929	7305	8.00	11.41
February & March 2023	920	7728	2036	9764	8.00	10.61
April & May 2023	1370	11508	2235	13743	8.00	10.03
Academic Year 2022-2023	**5830**	**44721**	**11289**	**56010**	**8.00**	**9.61**



Service Connection No. 1000 Self Supported Course –Secretary –
SMC Connected Load – 15KW **Tariff : LM2B2**

Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2021	1430	10725	4196	14921	7.50	10.43
August & September 2021	1330	9975	2329	12304	7.5	9.25
October & November 2021	1420	10650	2329	13025	7.5	9.17
December 2021 & January 2022	990	7425	2225	9650	7.5	9.75
February & March 2022	3150	23625	3041	26666	7.5	8.47
April & May 2022	2790	20925	2912	23837	7.5	8.54
Academic Year 2021-2022	**11110**	**83325**	**17032**	**100403**	**7.5**	**9.04**
June & July 2022	1220	9150	2324	11474	7.5	9.41
August & September 2022	2930	24095	3919	28015	7.5	9.56
October & November2022	1820	16244	3932	20176	8.5	11.09
December2022 & January2023	1690	15083	3844	18927	8.5	11.20
February & March 2023	2340	20873	4164	25036	8.5	10.70
April & May 2023	960	8563	3548	12111	8.5	12.62
Academic Year 2022-2023	**10960**	**94008**	**21731**	**115739**	**8.5**	**10.56**

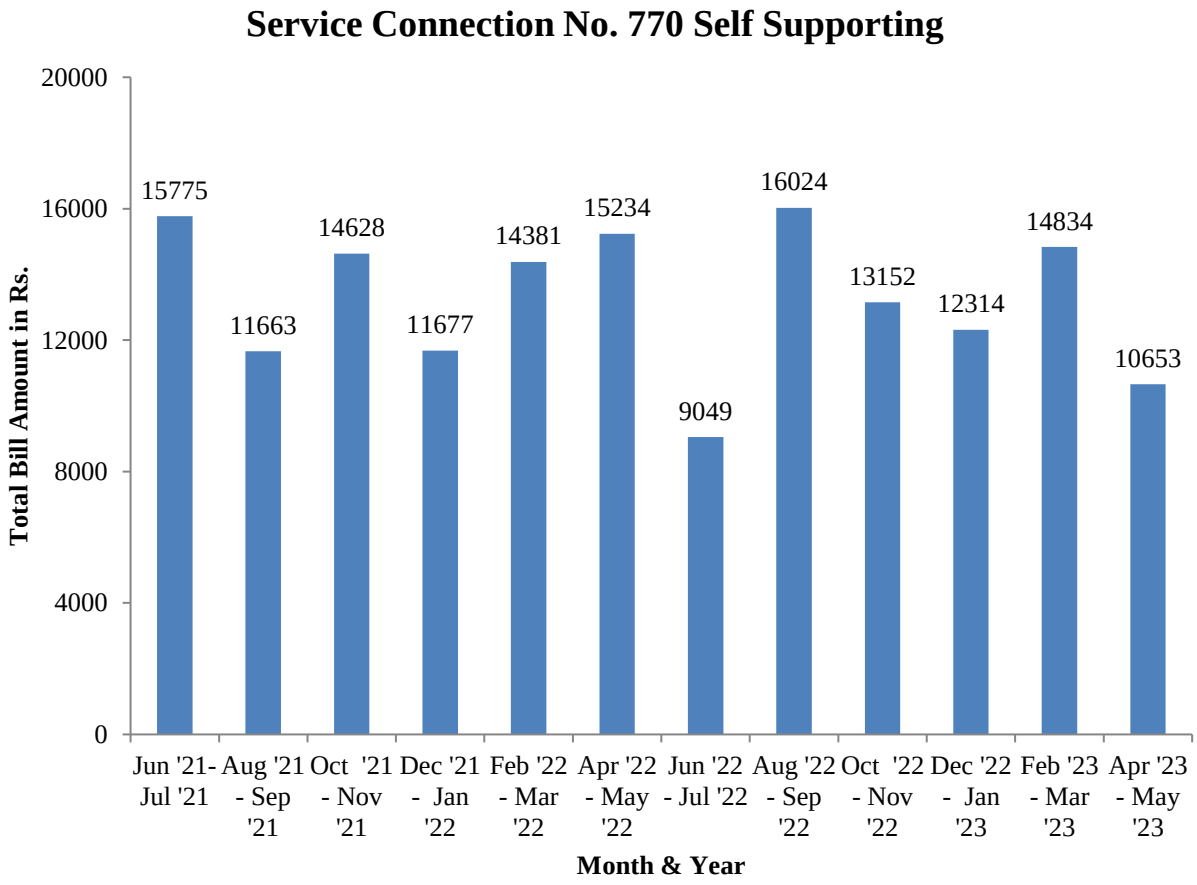


Service Connection No. 770 Self Supporting Course

Connected Load – 10 KW Tariff : LM51

Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2021	1530	12317	3458	15775	8.05	10.31
August & September 2021	1210	9741	1922	11663	8.05	9.64
October & November 2021	1560	12558	2070	14628	8.05	9.38
December 2021 & January 2022	1210	9741	1936	11677	8.05	9.65
February & March 2022	1530	12317	2065	14381	8.05	9.40
April & May 2022	1630	13122	2112	15234	8.05	9.35
Academic Year 2021-2022	**8670**	**69796**	**13563**	**83358**	**8.05**	**9.61**

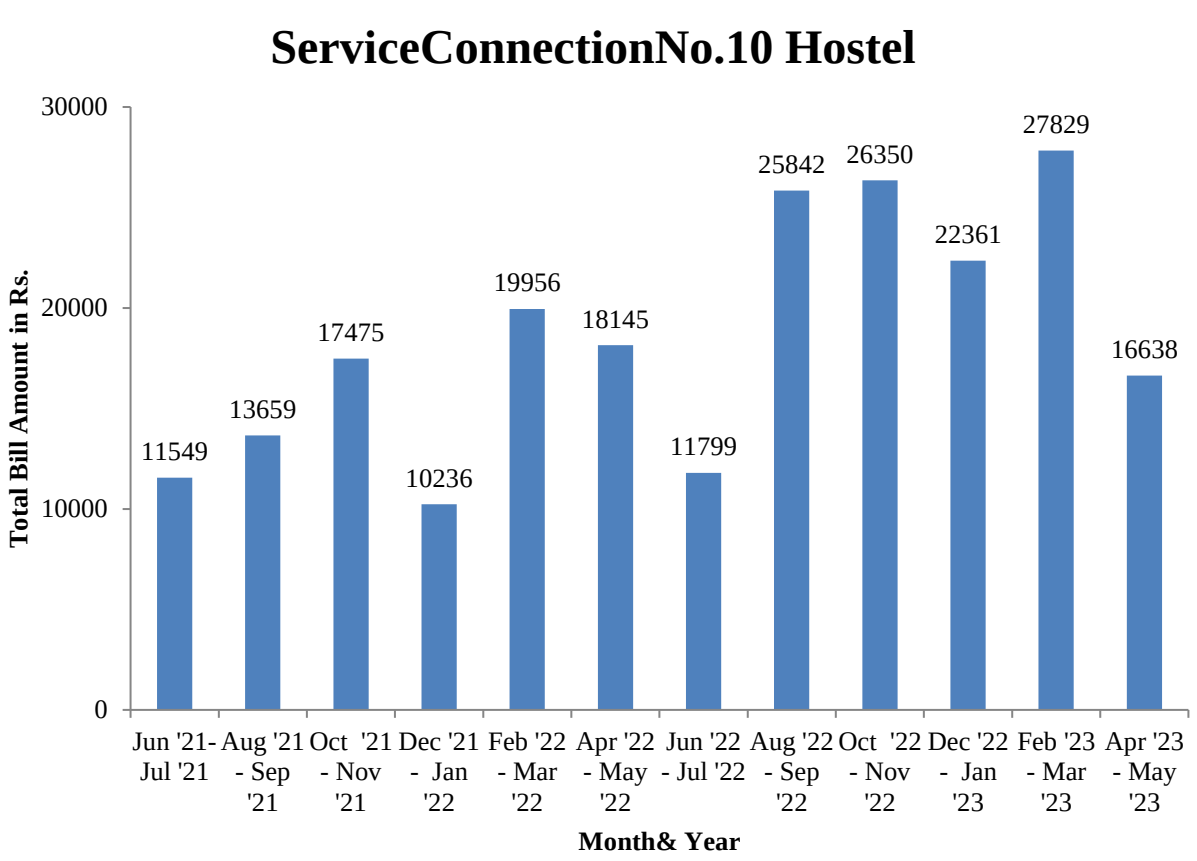
Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2022	900	7245	1804	9049	8.05	10.05
August & September 2022	1490	13450	2574	16024	9.5	10.75
October & November2022	1060	10574	2579	13152	9.5	12.41
December2022 & January2023	980	9776	2539	12314	9.5	12.57
February & March 2023	1220	12176	2659	14834	9.5	12.16
April & May 2023	820	8184	2469	10653	9.5	12.99
Academic Year 2022-2023	**6470**	**61405**	**14624**	**76026**	**9.5**	**11.75**



Service Connection No. 10 Hostel

Connected Load – 21KW Tariff : LM2B1

Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2021	1070	6153	5396	11549	5.75	10.79
August & September 2021	1840	10580	3079	13659	5.75	7.42
October & November 2021	2470	14203	3272	17475	5.75	7.07
December 2021 & January 2022	1270	7303	2933	10236	5.75	8.06
February & March 2022	2880	16560	3396	19956	5.75	6.93
April & May 2022	2580	14835	3310	18145	5.75	7.03
Academic Year 2021-2022	**12110**	**69634**	**21386**	**91020**	**5.75**	**7.52**
June & July 2022	1530	8798	3002	11799	5.75	7.71
August & September 2022	2970	21074	4769	25842	8.00	8.70
October & November2022	2500	21000	5350	26350	8.00	10.54
December2022 & January2023	2050	17220	5141	22361	8.00	10.91
February & March 2023	2670	22428	5401	27829	8.00	10.42
April & May 2023	1400	11760	4878	16638	8.00	11.88
Academic Year 2022-2023	**13120**	**102280**	**28541**	**130819**	**8.00**	**9.97**

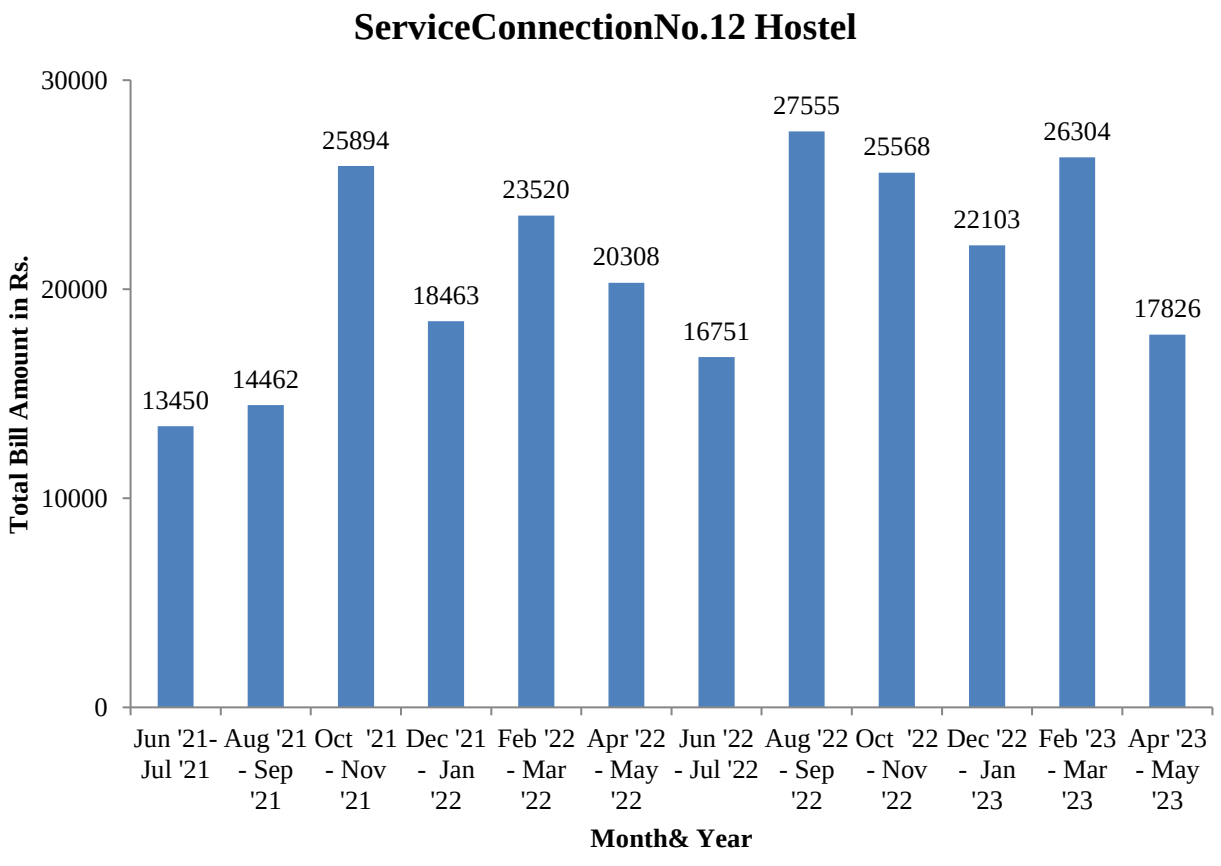


Service Connection No. 12 Hostel

Connected Load – 15KW Tariff : LM51

Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2021	1140	9177	4273	13450	8.05	11.80
August & September 2021	1460	11753	2709	14462	8.05	9.91
October & November 2021	2810	22621	3273	25894	8.05	9.21
December 2021 & January 2022	1930	15537	2926	18463	8.05	9.57
February & March 2022	2530	20367	3153	23520	8.05	9.30
April & May 2022	2150	17308	3000	20308	8.05	9.45
Academic Year 2021-2022	**12020**	**96763**	**19334**	**116097**	**8.05**	**9.66**

Month & Year	Energy Consumption In kWhr	Energy Consumption Charges in Rs.	Other Charges in Rs.	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
June & July 2022	1730	13927	2824	16751	8.05	9.68
August & September 2022	2610	23561	3994	27555	9.5	10.56
October & November2022	2150	21446	4122	25568	9.5	11.89
December2022 & January2023	1820	18155	3948	22103	9.5	12.14
February & March 2023	2220	22156	4148	26304	9.5	11.85
April & May 2023	1410	14072	3754	17826	9.5	12.64
Academic Year 2022-2023	**11940**	**113317**	**22790**	**136107**	**9.5**	**11.40**



The Maximum Demand availed for the Hostel LT Service No. 10 & 12 is utilized 50%. It is recommended to add additional load only to this LT Service connection to minimize the demand cost. The future load may be connected in this service till its reaches the availed Maximum Demand.

ENERGY CONSERVATION SCENARIO AND ENERGY SAVING MEASURES IMPLEMENTED

St. Mary's College (Autonomous), Thoothukudi, have performed well on the Energy conservation (ENCON) front. Many energy saving projects have been implemented.

TCE Energy Team analyzes the Energy Consumption pattern of all the LT Power Supply System on the aspect of variation of consumption with respect to college working days and vacation and found reasonable. TCE appreciates the excellent efforts of St. Mary's College (Autonomous), Thoothukudi team towards energy conservation and their achievements. St. Mary's College (Autonomous), Thoothukudi is one of the lowest energy consuming college among the arts colleges of equivalent strength, we have come across.

Summary of Annual Energy Consumption in the LT Power Supply in the Campus for the Academic Year 2022-2023

LT Service No.	Tariff	Annual Units Consumption in Kwh	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
13 College Main Supply	LM2B1	57940	382483	43.49	37.18
9 Dollarosa Building	LM2B1	10980	93976	36.49	36.73
851 Computer Science Block	LM2B1	13430	100259	25.5	17.88
953 COE	LM2B1	5900	40915	6.52	7.02

LT Service No.	Tariff	Annual Units Consumption in Kwh	Total Bill Amount In Rs.	Energy Cost Per kWh in Rs.	Overall Energy Cost per kWh in Rs.
1000 Self Supporting Course	LM2B2	10790	90793	11.15	11.89
770 – Self Supporting Course	LM51	6730	65507	9.74	7.16
10- Hostel	LM2B1	16680	116143	21.00	9.14
12 – Hostel	LM51	17060	157092	15.00	8.62
Overall		139510	1047168	168.89	135.62

Some of the important energy saving projects already implemented by St. Mary's College (Autonomous), Thoothukudi are as follows:

- Installation of 12Nos. of Solar PV Based Street Lighting System
- Use of Energy Efficient LED Tube Lights in few locations
- Efficient use of Sunlight for Day lighting purpose
- Installation of 10 kilowatts Grid connected Solar PV System
- User awareness on Energy Conservation practices.

St. Mary's College (Autonomous), Thoothukudi has a very good committed technical team. We feel that the concerted efforts of the committed plant personnel will help to realize the vision of being the Model energy efficient College in the country.

ENERGY SAVING PROPOSAL NO. 1

Replace Conventional Tube Light With Energy Efficient LED Tube Light

Background

The Conventional Tube Lights consume power 50 to 54 Watts. The breakup of power consumption in conventional Tube Light are 40 Watts for Tube Light and 10 to 14 Watts for the inherent iron losses and copper losses in the Choke. The Energy Efficient LED Tube Light consumes only 18 to 22Watts and produce same light levels.

The comparison of power consumption for conventional tube light and the energy efficient LED Tube Light is given below:

Power Consumption	Conventional Tube Light	Energy Efficient LED Tube Light
Tube light	40 Watts	20 Watts
Choke Loss	10 Watts	Nil
Saving in Watts		30 Watts

Recommendation

We recommend replacing the Conventional Tube Light fittings with Energy efficient LED Tube Light fittings.

We strongly recommend buying Philips Brand LED Tube lights for Quality and Reliability.

Benefits

The estimated annual savings is **Rs.1,58,000/-** with an investment of **Rs.1,43,000/-**, which will get paid back in **11** months.

Sample Calculations to work out the Annual Cost Saving and Payback period:

If a Conventional Tube lights burns for 6Hours daily and operates for 220days for Staffroom & Computer Laboratory lighting purpose.

Annual Energy for Conventional Tubelight is = 50Watts X 6Hours X 220days
= 66000Wh = 66kWh

Annual Energy Cost for Conventional Tubelight is= 66kWh X Rs.8.4/kWh
= Rs.554/-

Annual Energy for LED Tubelight is =20Watts X 6Hours X 220days
= 26400Wh = 26.4kWh

Annual Energy Cost for LED Tubelight is = 26.4kWh X Rs.8.4/kWh
= Rs. 222/-

Saving in Annual Energy Cost with LED Tubelight
= Rs.554 – Rs. 222 = Rs.332/-

Investment required for New LED Tubelight = Rs. 300/-

Payback period in month for the LED Tubelight
=(Investment/Energy Saving)X12
= (Rs.300 / Rs.332) X 12
= 10.84 $\cong$ 11 Months

Total Saving in Annual Energy Cost with LED Tubelights
= 476Nos. X Rs.332/- = Rs.158032/-

Total Investment required for New LED Tubelights =476Nos.XRs.300= Rs.142800/-

Payback period in month for the LED Tubelight
=(Investment/Energy Saving)X12
= (Rs.300 / Rs.332) X 12
= 10.84 $\cong$ 11 Months

Summary of Conventional Tube Lights in St. Mary's College Campus

Sl.No.	Hall	No. of tube Lights
1	Tube Lights in A-Halls	81
2	Tube Lights in B-Halls	54
3	Tube Lights in C-Halls	33
4	Tube Lights in D-Halls	89
5	Tube Lights in E-Halls	53
6	Tube Lights in F-Halls	48
7	Tube Lights in G-Halls	42
8	Tube Lights in H-Halls	37
9	Tube Lights in Hostel	39
	Total No. of Tube Lights in St Mary's College Campus	476

A-Halls

Room No.	Room Name	No. of Tube light
A03	Staff Office	19
A04	Zoology Museum	5
A05	I Zoology	8
A06	Marine Aquarium	14
A07	III Zoology	1
A09	Class Room	1
A10	II Botany	1
A11	I M.Sc. Botany	2
A12	Language Lab	1
A13	Botany Lab UG	8
A14	Botany instrumentation Lab	3
A16	Microbiology Lab	6
A17	II M.Sc. Botany	2
A18	Botany Staff Room / Museum	6
A19	Botany Research Lab	4
	No. of Tube Lights in A-Halls	81

B-Halls

Room No.	Room Name	No. of Tube light
B02	Student Office	6
B03	P.G.Chemistry Lab	7
B05	UG Chemistry lab I	2
B07	Instrumentation Lab	6
B08	Rest Room	2
B09	Vice Principal Room	1

Room No.	Room Name	No. of Tube light
B10	Maths Staff Room	2
B11	English Staff Room	1
B12	English Staff Room	1
B13	II Maths	1
B17	Maths Research Room	1
B18	I B.Com.	4
B19	II Chemistry	1
B20	III Chemistry	1
B21	Tamil Department	2
B23	I English Literature	3
B24	II Economics	2
B25	III Economics	3
B26	I Chemistry	1
B27	III Botany	1
B28	Botany Library	6
	No. of Tube Lights in B-Halls	54

C-Halls

Room No.	Room Name	No. of Tube light
C01	I Economics	2
C02	Department of Economics	2
C04	Physics Electronics lab	6
C05	Physics Lab	6
C06	Physics Store	1
C07	III Physics	2
C08	I Physics	2
C09	Physics Computer Lab	6
C10	Store Room	1
C11	Store Room	1
C12	B.Sc. Physics	2
C13	I Botany	2
	No. of Tube Lights in C-Halls	33

D-Halls

Room No.	Room Name	No. of Tube light
D01	Main Library	28
D02	III History	3
D03	II History	3
D04	I History	2
D05	II M.A.English	1
D06	Computer Science Lab	15
D07	UPS Room	5
D08	II Computer Science	1
D09	Computer Science Staff room	2
D10	III Computer Science	2
D11	M.Sc. Physics Lab	3
D12	M.Phil.English	1

Room No.	Room Name	No. of Tube light
D13	III B.Com.	4
D14	Language Lab	4
D15		3
D16		4
D17		4
D18	II Commerce	4
	No. of Tube Lights in D-Halls	89

E-Halls

Room No.	Room Name	No. of Tube light
E01	Controller Of Examinations	8
E02	Dean Office	5
E03	Audio Visual Room	4
E04	Central Computer Lab	3
E05	IQAC	1
	IQAC (Extn.)	3
E08	Guest House	7
E09	Fatima Hall	13
E13	Canteen First Floor	4
E14	Canteen First Floor	3
E15	NCC Room	1
E16	Department of Commerce	1
	No. of Tube Lights in E-Halls	53

F-Halls

Room No.	Room Name	No. of Tube light
F01	I M.Sc. Zoology	4
F02	P.G. Zoology Lab	6
F03	II M.Sc. Zoology	3
F04	PG Zoology Lab	9
F06	M.Phil	1
F07	Zoology instrumentation	3
F09	Commerce Office	1
F10	II M.Com.	2
F11	Library	2
F12	P.G. Library Commerce	3
F13	I M.Com.	2
F14	HRM Department	1
F15	I MHRM	2
F16	II MHRM	2
F17	M.A.History	2
F18	History Research Room	3
F19	P.G. Library	2
	No. of Tube Lights in F-Halls	48

G-Halls

Room No.	Room Name	No. of Tube light
G02	SS Office	7
G04	Microbiology Department	5
G05	Microbiology Department	5
G06	Class Room	3
G07	Store Room	6
G11	I B.Sc. Microbiology	3
G12	Computer Lab II	4
G13	Computer Lab I	2
G15	II Microbiology	4
	Corridor	3
	No. of Tube Lights in G-Halls	42

H-Halls

Room No.	Room Name	No. of Tube light
H02	II M.A. Literature	1
H03	Orchestra Room	1
H07	II M.Sc.Psychology	1
H09	Department of Psychology	1
H10	Career Guidance Cell	1
H12	II B.Sc. Psychology	2
H13	I B.Sc. Psychology	2
H14	Maths Research Room	1
H16	II M.Sc. Maths	2
H17	I M.Sc. Chemistry	1
H18	II M.Sc. Chemistry	1
H19	I B.Sc. Maths	1
H20	M.Phil. English	1
H21	Economics Department	1
H22	II M.A.Economics	1
H23	M.A.Economics	1
H24	II M.Sc. Physics	1
H25	I M.Sc. Physics	1
H26	I M.Sc.Maths	1
H27	Maths Department	1
H28	Physics Department	1
H29	Computer Science Department	1
H30	I M.Sc. Computer Science	1
H31	II M.Sc. Computer Science	1
H32	Physics Lab	1
H33	P.G. Physics Lab	1
H34	M.Phil.Maths	1
H35		1
H36		1
H37		1

Room No.	Room Name	No. of Tube light
H38	Musical Instruments Room	1
H40	Paper Store Room 3	1
H41	Counseling Centre	1
H42	Counseling Centre	1
	No. of Tube Lights in H-Halls	37

HOSTELS

Location	No. of Tube light
Terasa Hostel	25
Meditation Hall	12
Student centre	2
No. of Tube Lights in Hostel	39

ENERGY SAVING PROPOSAL NO. 2

Replace Conventional Ceiling Fan with Energy Efficient BLDC Ceiling Fan

Background

Presently conventional Ceiling Fans are used in Classroom, Staffroom, Office and Laboratories. The conventional Ceiling Fan consumes 65Watts, whereas the Energy Efficient BLDC (Brushless DC Motor) type ceiling fan consumes only 35Watts.

Around 660Nos. of Conventional Ceiling Fans are in operation St Mary's College Campus.

Recommendation

We recommend replacing the Conventional Ceiling Fan which consumes 65Watts with BLDC Ceiling fan in Office, Staffroom, Classroom and Laboratories.

Every year St. Mary's college Management will buy at least 50Nos. of BLDC Ceiling fans to replace the old Conventional ceiling Fans to conserve energy. Top priority will be given for the College office, Staff room and Classroom.

We strongly recommend buying Atomberg / Super Fan Brand BLDC Fan for Quality and Reliability.

Benefits

The estimated annual savings by replacing 50Nos. of Conventional Ceiling Fan with Energy Efficient BLDC Ceiling Fan is Rs.24,000/- with an investment of Rs.175,000/-, which will get paid back in 87 months.

Sample Calculations to work out the Annual Cost Saving and Payback period:

Annual Energy for 65Watts Conventional Ceiling Fan is

= 65WattsX8HoursX240days

= 124800Wh = 124.8kWh

Annual Energy Cost for 65Watts Conventional Ceiling Fan is

= 124.8kWh X Rs.8.40/kWh

= Rs.1048/-

Annual Energy for 35Watts BLDC Ceiling Fan is

=35WattX8Hours X 240days

= 67200Wh = 67.2kWh

Annual Energy Cost for 35Watts BLDC Ceiling Fan is

= 67.2kWh X Rs.8.40/kWh

= Rs. 564/-

Saving in Annual Energy Cost with BLDC Ceiling Fan is

= Rs.1048 – Rs.564 = Rs.484/-

Saving in Annual Energy Cost for 50nos. of BLDC Ceiling Fan is

= 50Nos. X Rs.484 = Rs. 24200/-

Investment required for 50Nos. of BLDC Ceiling Fan

= 50Nos. X Rs. 3500/- = Rs.175000/-

Payback period in month for the BLDC Ceiling Fan is

= (Investment/Energy Saving)X12

= (Rs.175000 / Rs.24200) X 12

= 86.77 $\cong$ 87 Months

Summary of Conventional Ceiling Fans in St. Mary's College Campus

Sl.No.	Hall	No. of Ceiling Fans
1	Ceiling Fans in A-Halls	48
2	Ceiling Fans in B-Halls	57
3	Ceiling Fans in C-Halls	52
4	Ceiling Fans in D-Halls	95
5	Ceiling Fans in E-Halls	121
6	Ceiling Fans in F-Halls	45
7	Ceiling Fans in G-Halls	83
8	Ceiling Fans in H-Halls	54
9	Ceiling Fans in Hostel	105
	Total No. of Ceiling Fans in St Mary's College Campus	660

A-Halls

Room No.	Room Name	No. of Ceiling Fan
A01	Principal Room	3
A02	Secretary Room	4
A03	Staff Office	8
A05	I Zoology	4
A06	Marine Aquarium	8
A07	III Zoology	2
A08	II Zoology	2
A09	Class Room	2
A10	II Botany	1
A11	I M.Sc. Botany	1
A12	Language Lab	1
A13	Botany Lab UG	6
A15	Instrumentation Room	1
A17	II M.Sc. Botany	1
A18	Botany Staff Room / Museum	3
A19	Botany Research Lab	1
	No. of Ceiling Fans in A- Halls	48

B-Halls

Room No.	Room Name	No. of Ceiling Fan
B02	Student Office	6
B04	Chemistry Staff Room	3
B06	UG Chemistry lab II	1
B08	Rest Room	2

Room No.	Room Name	No. of Ceiling Fan
B09	Vice Principal Room	2
B10	Maths Staff Room	2
B11	English Staff Room	6
B12	English Staff Room	3
B13	II Maths	2
B14	III Maths	2
B15	I Maths	2
B16	English Literature	3
B17	Maths Research Room	1
B18	I B.Com.	4
B19	II Chemistry	2
B20	III Chemistry	3
B21	Tamil Department	2
B23	I English Literature	3
B24	II Economics	2
B25	III Economics	3
B27	III Botany	1
B28	Botany Library	2
	No. of Ceiling Fans in B- Halls	57

C-Halls

Room No.	Room Name	No. of Ceiling Fan
C01	I Economics	2
C02	Department of Economics	3
C04	Physics Electronics lab	5
C05	Physics Lab	3
C06	Physics Store	1
C07	III Physics	3
C08	I Physics	3
C09	Physics Computer Lab	7
C12	B.Sc. Physics	3
C13	I Botany	4
C14	Auditorium	18
	No. of Ceiling Fans in C- Halls	52

D-Halls

Room No.	Room Name	No. of Ceiling Fan
D01	Main Library	33
D02	III History	2
D03	II History	3
D04	I History	2
D05	II M.A.English	2
D07	UPS Room	1
D08	II Computer Science	3
D09	Computer Science Staff room	2
D10	III Computer Science	3
D11	M.Sc. Physics Lab	4

Room No.	Room Name	No. of Ceiling Fan
D12	M.Phil.English	2
D13	III B.Com.	6
D14	Language Lab	6
D15		2
D16		6
D17		6
D18	II Commerce	6
	Corridor	6
	No. of Ceiling Fans in D- Halls	95

E-Halls

Room No.	Room Name	No. of Ceiling Fan
E01	Controller Of Examinations	11
E02	Dean Office	3
E03	Audio Visual Room	5
E04	Central Computer Lab	5
E05	IQAC	3
	IQAC (Extn.)	3
E07	Conference Theatre	21
E08	Guest House	8
E09	Fatima Hall	16
E10	Star Hall	17
E11	Canteen	15
E13	Canteen First Floor	6
E14	Canteen First Floor	4
E15	NCC Room	1
E16	Department of Commerce	3
	No. of Ceiling Fans in E- Halls	121

F-Halls

Room No.	Room Name	No. of Ceiling Fan
F01	I M.Sc. Zoology	2
F02	P.G. Zoology Lab	2
F03	II M.Sc. Zoology	2
F04	PG Zoology Lab	4
F06	M.Phil	2
F07	Zoology instrumentation	1
F09	Commerce Office	1
F10	II M.Com.	2
F11	Library	2
F12	P.G. Library Commerce	2
F13	I M.Com.	3
F14	HRM Department	1
F15	I MHRM	6
F16	II MHRM	6
F17	M.A.History	2

Room No.	Room Name	No. of Ceiling Fan
F18	History Research Room	4
F19	P.G. Library	3
	No. of Ceiling Fans in F- Halls	45

G-Halls

Room No.	Room Name	No. of Ceiling Fan
G01	Director Room	1
G02	SS Office	6
G03	Staff Dining	1
G04	Microbiology Department	4
G05	Microbiology Department	4
G06	Class Room	2
G07	Store Room	4
G08	I M.Sc. Microbiology	-
G09	III B.Sc. Microbiology	5
G10	II B.Sc. Microbiology	5
G11	I B.Sc. Microbiology	3
G12	Computer Lab II	3
G13	Computer Lab I	1
G15	II Microbiology	3
G16	III B.Com. Corporate	5
G17	III B.Com. 'B'	5
G18	III B.Com. 'A'	5
G19	Department of Commerce	5
G20	III B.A. English	5
G21	I B.B.A	5
G22	III B.B.A.	5
G23	II B.B.A.	5
G24	II B.Com Corporate	5
G25	I B.Com Corporate	5
G26	I B.Com. 'B' General	5
G27	I B.Com. 'A' General	5
G28	II B.A. English	5
G29	I B.B.A.	5
G30	II B.Com. 'A'	5
G31	II B.Com. 'B'	5
	No. of Ceiling Fans in G- Halls	83

H-Halls

Room No.	Room Name	No. of Ceiling Fan
H01	Physical Director	2
H02	II M.A. Literature	2
H03	Orchestra Room	1
H04	Department of Tamil	1
H05	NSS Room	1
H07	II M.Sc.Psychology	1

Room No.	Room Name	No. of Ceiling Fan
H08	I M.Sc.Psychology	1
H09	Department of Psychology	1
H10	Career Guidance Cell	1
H11	III B.Sc. Psychology	1
H12	II B.Sc. Psychology	3
H13	I B.Sc. Psychology	3
H14	Maths Research Room	1
H15	III B.Sc. Maths	3
H16	II M.Sc. Maths	4
H17	I M.Sc. Chemistry	1
H18	II M.Sc. Chemistry	1
H19	I B.Sc. Maths	1
H20	M.Phil. English	1
H21	Economics Department	1
H22	II M.A.Economics	1
H23	M.A.Economics	1
H24	II M.Sc. Physics	1
H26	I M.Sc.Maths	1
H27	Maths Department	2
H28	Physics Department	1
H29	Computer Science Department	2
H30	I M.Sc. Computer Science	1
H31	II M.Sc. Computer Science	1
H33	P.G. Physics Lab	1
H34	M.Phil.Maths	1
H35		1
H36		2
H37		1
H38	Musical Instruments Room	1
H39	II B.Sc. Physics	2
H40	Paper Store Room 3	1
H41	Counseling Centre	1
H42	Counseling Centre	1
	No. of Ceiling Fans in G- Halls	54

HOSTELS

Location	No. of Ceiling Fan
New Hostel	47
Terasa Hostel	25
Meditation Hall	12
Dining Hall	20
Student Centre	1
No. of Ceiling Fans in Hostel	105

ENERGY SAVING PROPOSAL NO. 3

Switch-Off Line Interactive Uninterrupted Power Supply (UPS) Systems While Closing the Laboratory

Background

The Uninterrupted Power Supply (UPS) systems are switched ON throughout the year. The major LT Power supply systems are provided with Diesel Generator Set (DG) backup and can be started with a maximum delay of 10Minutes. The UPS systems are provided with 15 Minutes to 30 Minutes battery backup.

After laboratory hours the UPS Systems consumes idle / No-load power for its inherent losses. A 3KVA UPS will consumes 150Watts power at no-load.There is a good scope to minimize no-load power consumption by switching OFF of UPS running idle. The Sealed Maintenance Free (SMF) batteries are used in UPS System. This also helps to improve the life of SMF batteries due to regular charging and discharging.

Recommendation

Switch ON UPS systems as and when required. After the college closes, switch off the UPS systems. Avoid idle running of UPS systems. The typical operating hours of UPS System in an year is around 8Hours per Day and 250Days in an year and equivalent to 2000 Hours and Whereas the idle running period is 6760 Hours per year.

Location	Rating	No load power in Watts
Physics Computer Lab UPS	3 kVA	150
Dolorasa Auditorium UPS No.1	3 kVA	170
Dolorasa Auditorium UPS No.2	5 kVA	160
Valan Computer lab UPS No.1	6 kVA	275
Valan Computer lab UPS No.2	6 kVA	190
II MHRM Lab	3 kVA	150
Total Savings Potential in Watts		795 Watts

Energy Saving potential = 0.795KiloWatts X 16Hrs X 365days X Rs.8.40/-
= Rs.38999/-

Benefits

The estimated annual savings potential by Switching OFF the UPS is **Rs.39,000/-.**

Whenever the Server is kept under shutdown condition, It is also recommended to Switch-off the COE Office UPS also after CollegeHours,.

ENERGY SAVING PROPOSAL NO. 4

Remove Stabilizer for Inverter Based Refrigerators

Background

The Inverter based Refrigerators are relatively more efficient than the Conventional Refrigerators. The latest Inverter based Refrigerators don't requires stabilizers for its operation. The refrigerators' supplier also clearly mentioned that Stabilizer free operation by fixing a sticker, which is stick on the refrigerators. A typical 500VA Stabilizer will consumes 30 to 40Watts for its inherent losses. Presently 5 nos. of inverter based refrigerators are used in St. Mary's College, Thoothukudi.

Recommendation

We recommend to connect the Inverter based Refrigerator directly to thePower Supply and uninstall the Stabilizer used. In future needs, we recommend to buy inverter based Air-conditioners and Refrigerators to minimize the power consumption.

Location	Device Type	No load power consumption in Stabilizers in Watts
B.Sc. Micro Biology Lab	Inverter based Refrigerator	30
B.Sc. Micro Biology Classroom	Inverter based Refrigerator	30
Zoology Department Store	Inverter based Refrigerator	30
M.Sc. Botany Lab	Inverter based Refrigerator	30
Hostel Kitchen	Inverter based Refrigerator	30
Total Savings Potential in Watts		150 Watts

Energy Saving potential = 0.15 Kilowatts X 8000Hrs. X Rs.8.40/- = Rs.10080/-

Benefits

The estimated annual savings potential by uninstalling the Stabilizer for Inverter based Refrigerator is **Rs.10,000/-.**

CHAPTER V

METHODOLOGY ADOPTED FOR THE ENERGY AUDIT STUDY

St. Mary's College (Autonomous), Thoothukudi, evinced interest in availing the services of TCE - EMC - Energy Management Cell to conduct Detailed Energy audit. The scope of services for conducting the detailed energy audit at St. Mary's College (Autonomous), Thoothukudi is as follows.

DETAILED ENERGY AUDIT

The Detailed Energy Audit study has covered all types of energy at St. Mary's College (Autonomous), Thoothukudi. Based on our past experience and information provided by St. Mary's College (Autonomous), Thoothukudi. The following areas are looked into detail for energy saving opportunities.

ELECTRICAL DISTRIBUTION SYSTEM

During the Detailed Energy Audit, Electrical Distribution System has been studied in the following aspects:

- To reduce distribution and cable losses
- To reduce transformer loss
- Sufficiency of capacitors
- Performance of capacitors etc.

LIGHTING SYSTEM

TCE - EMC has studied the lighting system at St. Mary's College (Autonomous), Thoothukudi in the following aspects for energy savings:

- Installation of electrical energy savers in lighting system
- Energy efficient lighting practices
- Modification in lighting system to minimize power consumption

AIR-CONDITIONERS

TCE – EMC has studied the Air-conditioners, which consumes the major portion of power. The Air-conditioners are studied with the following points in mind:

- Deliver Air Temperature
- Return Air Temperature
- Power Consumption & Power Factor

METHODOLOGY OF DETAILED ENERGY AUDIT STUDY

Detailed energy audit has conducted on 21st and 22nd June 2023.

St. Mary's College (Autonomous), Thoothukudi management has named Mr. A. Antony Loyala, Laboratory Assistant, as co-ordinator. He has coordinated for all the Data Collection and for measurements.

At the end of the Detailed Energy Audit, all the findings have been discussed with operating, maintenance and senior executives, concerned, for their feedback.

A discussion has been made on 22nd June 2023 with the college personnel on the findings of the Detailed Energy Audit study.

Based on the report presented, St. Mary's College (Autonomous), Thoothukudi can initiate implementation activities, to reap full benefits.

CHAPTER VI

SCOPE FOR IMPROVEMENT

IMPROVEMENT OPPORTUNITIES

During the Detailed Energy Audit at St. Mary's College (Autonomous), Thoothukudi, TCE team and St. Mary's College team identified some of the possible areas to improve further, Which will gives energy saving but it won't payback within three years of time and also difficult to quantify in some cases. But, it also increases the reliability of the equipment in a great extent.

INSTALL SLEEP MODE FACILITY FOR ALL THE COMPUTER SYSTEM

The computer system running in idle mode consumes 90 – 120Watts of power depending upon the size of the monitor 15" or 19". There is a provision available in the computer system to set the computer to sleep mode. In the sleep mode of operation the monitor power consumption is nil & system will consume a little bit of power to restore the earlier status.

The recommended times to set for the sleep mode for various devices in Computer System are as follows:

- Monitor will go to Sleep mode if the System is idle for 5 Minutes.
- Hard disk will go to Sleep mode if the System is idle for 10 Minutes.
- Processor will go to Sleep mode if the System is Idle for 15 Minutes.

This needs to be done in all Computer Systems in the Campus by the Computer Laboratory Technicians and reviewed regularly on monthly basis to verify the practice is continuing or stopped practicing the same.

Recommendation

It is strongly recommended to implement the sleep mode facility to minimize the power consumption in Computer Systems.

Note : The screen saver mode of operation only saves the life of screen, but the sleep mode saves the power & life of screen.

INSTALL COMMON UPS INSTEAD OF STANDALONE 0.5KVA UPS IN LABORATORY

Background

The Standalone 0.5KVA UPS systems are used in Computer Laboratory No.2 at Madonna Building and College Main office. Whenever more than 10Nos. of Computer Systems are installed in a location, it is recommended to install common UPS System to minimize the losses. The no-load power consumption of 0.5KVA UPS is around 30 to 40Watts, whereas for a 3KVA UPS Systems is around 170Watts. The reliability of 3KVA UPS System is relative more than the0.5KVA UPS System.

Recommendation

We recommend replacing 0.5KVA standalone UPS Systems with 3KVA Group UPS systems to minimize the power consumption.

MARKING OF SWITCH CONTROL FOR LIGHTS and FANS

Presently in Laboratories the students find difficulties to identify the switch for a tube light / fan. Hence, their tendency is switching ON all the switches and do the works even few Lights and Fans are not required in the Laboratories.

Number the Light, Fan & Air conditioner and Marking should be done on Switch point as well as near the Tube light, Fan & Air conditioners in laboratories. This will helpful to the students to switch ON the required Tube light and Fan.

INSTALL PEDESTAL FAN & AVOID USE OF AIR-CONDITIONERS DURING NON-LABORATORY HOURS

During Regular laboratory class hours, the no. of students inside the laboratory is around 25 to 50. The air-conditioners are designed to cool and maintain the temperature & humidity for comfort during Regular laboratory class hours. But non-laboratory class hours, the no. of persons working in the computer laboratory is

very few. During this period, there is a good scope to reduce energy consumption by using pedestal fan and avoiding use of air- conditioners.

SUBMERSIBLE PUMPS TO REPLACE THE MONOBLOCK PUMPS FOR WATER PUMPING

The monoblock pumps are used for pumping of water from the sump to overhead tank. The suction heads is zero for Submersible water pumps and more efficient than the monoblock pumps. It is recommended to replace the Monoblock pumps with Submersible pumps, whenever the old pumps fails. Rewinding of the old pumps may be avoided and the failed pump may be replaced with submersible water pump.

INSULATION REPLACEMENT IN DOLLOROSA BUILDING CENTRAL AIR-CONDITIONING SYSTEM

In Dollarosa Building, Centralized Air-conditioning has been installed for air-conditioning the Auditorium. The insulation provided for the refrigerant handling pipeline was in failed condition due to ageing. This leads to loss of chillness to the ambient and results in excess power consumption in the Air-conditioners. It is recommended to revamp the thermal insulation for the pipelines to minimize the power consumption in the air-conditioners.

SAFETY AND OTHER IMPROVEMENT OPPORTUNITIES

During the Detailed Energy Audit, the TCE Energy Team observed Temporary wiring in few locations. This needs to be made permanent to increase the safety.

The TCE Energy Team recommends replacing the old Fuse Distribution system with MCB Distribution board for better protection from faults and to improve the safety.

Unused / Faulty Equipment and materials are stored in UPS Rooms and EB Metering rooms need to be disposed with proper permission and approval from the authorities.

CHAPTER - VII

MANAGEMENT ASPECTS & CONCLUSIONS

The Objectives of St. Mary's College (Autonomous), Thoothukudi, Should be

- Make Energy conservation a permanent activity at St. Mary's College (Autonomous), Thoothukudi.
- To achieve lowest energy cost without compromising quality of Educational Services
- One of the best Energy Efficient Colleges in India
- To achieve this objective, a firm top management commitment is required at the highest level that the college wants to conserve energy on a time bound basis.
- The top priority is to implement the recommended proposals and reap benefits.

APPROACH TO AN ENERGY CONSERVATION IDEA

Each energy conservation idea should be seen as an opportunity for improvement. The approach must be on how to implement each proposal and overcome the problems, if any.

It is easier to say a proposal is not possible or not implementable but the benefit comes from the actual implementation, which needs lot of courage, conviction, will power and perseverance to implement.

SPECIFIC RECOMMENDATION

St. Mary's College (Autonomous), Thoothukudi, should form an energy conservation committee. The committee should consist of senior operating and maintenance personnel.

The committee should meet once in a month with a specific agenda to review the progress of implementation of proposals and to guide the implementation team. St. Mary's College, Thoothukudi, should also select a senior person, as energy manager and he should coordinate all implementation activities.

The main responsibility of implementing the proposals and achievement of savings should be with the concerned operating and maintenance personnel and not with the energy manager.

The immediate task of St. Mary's College (Autonomous), Thoothukudi, should be to implement the identified proposals and get the savings.

We would recommend St. Mary's College (Autonomous), Thoothukudi, to introduce a suggestion scheme for energy conservation. The energy conservation committee should review all suggestions and good proposals should be implemented. The originator for the good suggestion, which has been successfully implemented, have to be rewarded.

ASSIGN SPECIFIC RESPONSIBILITY

While the overall responsibility for energy conservation rests with the top management, the concerned college operators / maintenance personnel should implement and report progress on energy saving proposals.

Therefore, each energy saving proposal should be assigned to a specific operating / maintenance personnel for implementation and monitoring.

Specific time bound action plan is required for implementation and monitoring of energy saving proposals.

CONCLUSIONS

- TCE energy audit team and St. Mary's College (Autonomous), Thoothukudi, energy team and have jointly identified proposals for implementation.
- An annual savings potential of **Rs.231000/-** can be realized by implementing the recommended proposals
- Out of the total Annual savings identified **Rs. 49000/-** can be achieved without any investment.
- The savings of **Rs. 1,82,000/-** can be achieved with an investment of **Rs 2,31,000**, which will be paid back in **21** months.
- Implementation of identified proposals should be given top priority and should be done step-by-step.

St. Mary's College (Autonomous), Thoothukudi, Should :

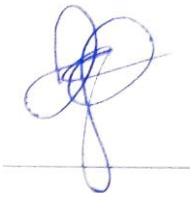
- Assign specific responsibility for implementation of proposals
- Monitor savings achieved proposal by proposal
- Monitor overall Energy Consumption in each LT Supply availed – area wise
- St. Mary's College (Autonomous), Thoothukudi should have the goal of becoming the best energy efficient College in India

ANNEXURE – A

DETAILS OF LOW TENSION SERVICES

Name of the LT Consumer	: St. Mary's College, Thoothukudi
Service Connection No.	: 9,10,12,13,770,851,953 &1000
Sanctioned Maximum Demand	: 168.89 Kilowatts
Classification of Industry	: Institution Building
Nature of Products Manufactured	: Service
Name of the Product Manufactured	: Service
Full Postal address with Phone No.	: ECR Road (SH-43), Cruz Puram Thoothukudi Pin code – 628 001. Phone No. 0461 232 0946 Fax No. 0461 232 0947
Private / Public Sector	: Government Aided
Specific Energy Consumption	: Not Applicable
Energy Audit Organization	: Energy Management Cell Thiagarajar College of Engineering, Madurai – 625 015

Team of Engineers conducted Energy Audit studies

Sl.No	Name of the Person	Discipline	Signature
1.	Dr.D.Nelson Jayakumar	Approved Energy Auditor by BEE / Assistant Professor in Electrical & Electronics Engineering	
2.	Dr.V.Saravanan	Professor inElectrical & Electronics Engineering	
3.	Dr.P.S.Manoharan	Professor inElectrical & Electronics Engineering	
4.	Dr.B.Ashok Kumar	Assistant Professor in Electrical & Electronics Engineering	

Details of Energy Audit Study

Date of Commencement of Detailed energy Audit Study : 21st June 2023

Date of Completion of Detailed energy Audit Study : 22nd June 2023

Date of Submission of Three copies of Detailed Energy Audit Reports to the consumer : 25th September 2023

Consolidated Details of Electrical Equipment at St. Mary's College Campus, Thoothukudi

A-Halls

Room No.	Room Name	Tubelight	Fan	LED	Others
A01	Principal Room	-	3	-	6 round+ 6(2x1) CFL+AC
A02	Secretary Room	-	4	1	15 CFL
A03	Staff Office	19	8	7	
A04	Zoology Museum	5	-	-	
A05	I Zoology	8	4	-	
A06	Marine Aquarium	14	8	-	1 F
A07	III Zoology	1	2	-	
A08	II Zoology	-	2	2	
A09	Class Room	1	2	-	
A10	II Botany	1	1	-	
A11	I M.Sc. Botany	2	1	-	
A12	Language Lab	1	1		2 Ton AC X 1
A13	Botany Lab UG	8	6	5	
A14	Botany instrumentation Lab	3	-	1	6 CFL
A15	Instrumentation Room	-	1	-	6 CFL 2 Ton AC X 2
A16	Microbiology Lab	6	-	2	2 Ton AC X 3 Fridge X 3
A17	II M.Sc. Botany	2	1	-	
A18	Botany Staff Room / Museum	6	3	3	
A19	Botany Research Lab	4	1	-	
A20	Botany Lecture Theatre	-	-	-	20 CFL 2 Ton AC X 2

B-Halls

Room No.	Room Name	Tubelight	Fan	LED	Others
B01					
B02	Student Office	6	6	1	
B03	P.G.Chemistry Lab	7	-	3	1Fridge
B04	Chemistry Staff Room	-	3	3	
B05	UG Chemistry lab I	2	-	4	
B06	UG Chemistry lab II	-	1	-	
B07	Instrumentation Lab	6	-	-	
B08	Rest Room	2	2	-	
B09	Vice Principal Room	1	2	-	1 CFL
B10	Maths Staff Room	2	2	-	

Room No.	Room Name	Tubelight	Fan	LED	Others
B11	English Staff Room	1	6	1	
B12	English Staff Room	1	3	2	
B13	II Maths	1	2	1	
B14	III Maths	-	2	-	
B15	I Maths	-	2	1	
B16	English Literature	-	3	5	
B17	Maths Research Room	1	1	-	
B18	I B.Com.	4	4	-	
B19	II Chemistry	1	2	-	1 CFL
B20	III Chemistry	1	3	1	
B21	Tamil Department	2	2	-	
B23	I English Literature	3	3	-	
B24	II Economics	2	2	-	
B25	III Economics	3	3	-	
B26	I Chemistry	1	-	-	
B27	III Botany	1	1	1	
B28	Botany Library	6	2	2	

C-Halls

Room No.	Room Name	Tubelight	Fan	LED	Others
C01	I Economics	2	2	-	
C02	Department of Economics	2	3	1	
C04	Physics Electronics lab	6	5	-	
C05	Physics Lab	6	3	5	
C06	Physics Store	1	1	1	
C07	III Physics	2	3	-	
C08	I Physics	2	3	-	
C09	Physics Computer Lab	6	7		3kVA UPS
C10	Store Room	1	-	-	
C11	Store Room	1	-	-	
C12	B.Sc. Physics	2	3	2	
C13	I Botany	2	4	4	
C14	Auditorium		18	36(2X2) CFL 24 Round CFL **Focus lights:** Halogen 100 W - 2 LED- 1 Neon – 2	

D-Halls

Room No.	Room Name	Tubelight	Fan	LED	Others
D01	Main Library	28	33	1	1 AC
D02	III History	3	2	-	

Room No.	Room Name	Tubelight	Fan	LED	Others
D03	II History	3	3	-	
D04	I History	2	2	-	
D05	II M.A.English	1	2	-	
D06	Computer Science Lab	15	-	5	3 X 2 Ton AC
D07	UPS Room	5	1	-	6 kVA X 2 UPS
D08	II Computer Science	1	3	-	
D09	Computer Science Staff room	2	2	-	
D10	III Computer Science	2	3	-	
D11	M.Sc. Physics Lab	3	4	1	
D12	M.Phil.English	1	2	-	
D13	III B.Com.	4	6	-	
D14	Language Lab	4	6	-	
D15		3	2	-	
D16		4	6	-	
D17		4	6	-	
D18	II Commerce	4	6	-	
	Corridor	-	6	-	

E-Halls

Room No.	Room Name	Tubelight	Fan	LED	Others
E01	Controller Of Examinations	8	11	11	2 AC
E02	Dean Office	5	3	-	1 AC
E03	Audio Visual Room	4	5	4	3 AC 3 kVA,5 kVA, 70 kVA stabilizer
E04	Central Computer Lab	3	5	4	2 AC
E05	IQAC	1	3	1	10 Round LED 1 AC
	IQAC (Extn.)	3	3	3	1 AC 3 kVA UPS X 2
E07	Conference Theatre	-	21	70	12.5 tonne AC X 4
E08	Guest House	7	8	1	4 AC
E09	Fatima Hall	13	16	3	
E10	Star Hall	-	17	15	
E11	Canteen	-	15	13	
E13	Canteen First Floor	4	6	-	
E14	Canteen First Floor	3	4	-	
E15	NCC Room	1	1	-	
E16	Department of Commerce	1	3	4	

F-Halls

Room No.	Room Name	Tubelight	Fan	LED	Others
F01	I M.Sc. Zoology	4	2	2	
F02	P.G. Zoology Lab	6	2	-	1 F
F03	II M.Sc. Zoology	3	2	-	
F04	PG Zoology Lab	9	4	2	
F05	NA				
F06	M.Phil	1	2	1	
F07	Zoology instrumentation	3	1	1	
F08	Zoology Office	-	-	-	
F09	Commerce Office	1	1	-	
F10	II M.Com.	2	2	-	
F11	Library	2	2	1	
F12	P.G. Library Commerce	3	2	-	
F13	I M.Com.	2	3	-	
F14	HRM Department	1	1	-	
F15	I MHRM	2	6	-	
F16	II MHRM	2	6	-	5kVA UPS
F17	M.A.History	2	2	-	
F18	History Research Room	3	4	2	
F19	P.G. Library	2	3	2	

G-Halls

Room No.	Room Name	Tubelight	Fan	LED	Others
G01	Director Room	-	1	4(Square)	
G02	SS Office	7	6	8	
G03	Staff Dining	-	1	-	
G04	Microbiology Department	5	4	-	
G05	Microbiology Department	5	4	-	
G06	Class Room	3	2	-	
G07	Store Room	6	4	-	
G08	I M.Sc. Microbiology	-	-	-	
G09	III B.Sc. Microbiology	-	5	2(Square)	
G10	II B.Sc. Microbiology	-	5	2(Square)	
G11	I B.Sc. Microbiology	3	3	-	
G12	Computer Lab II	4	3	-	
G13	Computer Lab I	2	1	-	
G14	Audio Visual Room	-	-	-	
G15	II Microbiology	4	3	-	
G16	III B.Com. Corporate	-	5	9	
G17	III B.Com. ‘B’	-	5	9	
G18	III B.Com. ‘A’	-	5	9	
G19	Department of Commerce	-	5	10	
G20	III B.A. English	-	5	9	
G21	I B.B.A	-	5	9	

Room No.	Room Name	Tubelight	Fan	LED	Others
G22	III B.B.A.	-	5	9	
G23	II B.B.A.	-	5	9	
G24	II B.Com Corporate	-	5	9	
G25	I B.Com Corporate	-	5	9	
G26	I B.Com. 'B' General	-	5	9	
G27	I B.Com. 'A' General	-	5	9	
G28	II B.A. English	-	5	9	
G29	I B.B.A.	-	5	9	
G30	II B.Com. 'A'	-	5	9	
G31	II B.Com. 'B'	-	5	9	
	Corridor	3			

H-Halls

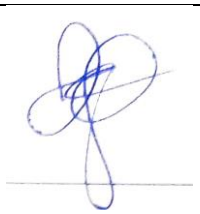
Room No.	Room Name	Tubelight	Fan	LED	Others
H01	Physical Director	-	2	1	
H02	II M.A. Literature	1	2	-	
H03	Orchestra Room	1	1	-	
H04	Department of Tamil	-	1	1	
H05	NSS Room	-	1	1	
H06	Cookery	-	-	1	
H07	II M.Sc.Psychology	1	1	-	
H08	I M.Sc.Psychology	-	1	1	
H09	Department of Psychology	1	1	-	
H10	Career Guidance Cell	1	1	-	
H11	III B.Sc. Psychology	-	1	1	
H12	II B.Sc. Psychology	2	3	-	
H13	I B.Sc. Psychology	2	3	-	
H14	Maths Research Room	1	1	1	
H15	III B.Sc. Maths	-	3	1	
H16	II M.Sc. Maths	2	4	-	
H17	I M.Sc. Chemistry	1	1	-	
H18	II M.Sc. Chemistry	1	1	-	
H19	I B.Sc. Maths	1	1	-	
H20	M.Phil. English	1	1	-	
H21	Economics Department	1	1	-	
H22	II M.A.Economics	1	1	-	
H23	M.A.Economics	1	1	-	
H24	II M.Sc. Physics	1	1	-	
H25	I M.Sc. Physics	1	-	1	
H26	I M.Sc.Maths	1	1	-	
H27	Maths Department	1	2	-	
H28	Physics Department	1	1	-	
H29	Computer Science Department	1	2	-	
H30	I M.Sc. Computer Science	1	1	-	
H31	II M.Sc. Computer Science	1	1	-	
H32	Physics Lab	1	-	1	

Room No.	Room Name	Tubelight	Fan	LED	Others
H33	P.G. Physics Lab	1	1	-	
H34	M.Phil.Maths	1	1	-	
H35		1	1	-	
H36		1	2	-	
H37		1	1	-	
H38	Musical Instruments Room	1	1	-	
H39	II B.Sc. Physics	-	2	1	
H40	Paper Store Room 3	1	1	-	
H41	Counseling Centre	1	1	-	
H42	Counseling Centre	1	1	-	

HOSTELS

Location	Tubelight	Fan	LED	Others
New Hostel	-	47	47	
Terasa Hostel	25	25	-	
Meditation Hall	12	12	-	
Dining Hall	-	20	18	
Student centre	2	1	1	

Team of Engineers conducted Energy Audit Studies

Sl.No	Name of the Person	Discipline	Signature
1.	Dr. D. Nelson Jayakumar	Approved Energy Auditor by BEE / Assistant Professor in Electrical & Electronics Engineering	
2.	Dr.V.Saravanan	Professor, Department of Electrical & Electronics Engineering	
3.	Dr.P.S.Manoharan	Professor, Department of Electrical & Electronics Engineering	
4.	Dr.B.Ashok Kumar	Associate Professor, Department of Electrical & Electronics Engineering	

EXECUTIVE SUMMARY

Thiagarajar College of Engineering (TCE), energy audit team conducted a Detailed Energy Audit at St. Mary's College (Autonomous), Thoothukudi on 20th & 21st August 2018. The list of Energy auditors is enclosed as **Annexure A**.

The methodology adopted for conducting the detailed energy audit are basic data collection, measurement at major electrical energy consuming equipment and analysis of data collected and identification of specific energy saving proposals.

TCE energy team and St. Mary's team have together identified an annual energy saving potential of **Rs. 268200/-** based on present energy cost.

The summary of annual savings identified is as below:

a)	Annual savings without investment (2 proposals)	:	**Rs. 40000/-**
b)	Annual savings with investment (2 proposals)	:	**Rs. 170000/-**
c)	Total Annual Savings (4 proposals)	:	**Rs. 210000/-**
d)	Investment Required	:	**Rs. 268200/-**
e)	Average payback period for capital proposals	:	**15 Months**

SPECIFIC ACTION PLAN

a) St. Mary's College (Autonomous), Thoothukudi, should identify specific person or department to implement the above proposals.
b) Specific target date for implementation of proposals should be made within 30 days of submission of this report.

c) St. Mary's College (Autonomous), Thoothukudi, should prioritize the above proposals and implement them in a phased manner.

d) In our opinion all the proposals can be implemented within one year, straightaway and should be on top priority.

e) St. Mary's College (Autonomous), Thoothukudi, should form an energy committee. The Secretary should head the committee. The committee should meet once in Three months and review the progress of implementation activity and identify new areas for energy conservation.

ACKNOWLEDGEMENT

TCE acknowledges with thanks for the cooperation and hospitality extended to the TCE energy audit team, during the detailed energy audit study at St. Mary's College (Autonomous), Thoothukudi. We appreciate the management for their commitment and focus given to the energy conservation towards improving economy.

We would like to place our sincere thanks to Sr. Flora Mary - Secretary, Sr.A.S.J.Lucia Rose, Principal and Management of St. Mary's College (Autonomous), Thoothukudi for entrusting the Energy Audit work with us.

We express our thanks and appreciation for the following executives and staff members of St. Mary's College (Autonomous), Thoothukudi.

1. Sr. Jessily Rita - Procurator
2. Mr. A.Antony Loyala - Laboratory Assistant
3. Mr. C.Ans Kumar - Electrical / Plumbing Worker
4. Mr.D.Antony Charles - Record Clerk

CHAPTER I

INTRODUCTION

St. Mary's College (Autonomous), Thoothukudi evinced interest in availing the services of Thiagarajar College of Engineering (TCE), Madurai for conducting a Detailed Energy Audit at their College premises. Further to that, TCE – Energy Management Cell submitted a proposal to conduct a Detailed Energy Audit.

The TCE proposal for conducting Detailed energy Audit was accepted by St. Mary's College (Autonomous), Thoothukudi. This report on Detailed Energy Audit study conducted at St. Mary's College (Autonomous), Thoothukudi, is in accordance with TCE's proposal agreed by St. Mary's College (Autonomous), Thoothukudi.

The methodology adopted for conducting the Detailed Energy Audit at St. Mary's College (Autonomous), Thoothukudi is as follows:

- Basic data collection on list of power consuming equipment, production capacities of the major equipment and operating parameters
- Power measurements of major electrical energy equipment
- Measurement of operating parameters of various equipment to estimate their operating efficiency
- Analysis of data collected and measurements to develop specific energy saving proposals
- Discussion with the St. Mary's College personnel on the identified proposals

An awareness programme was also conducted on 21st August 2018 for the staff members and students of St. Mary's College, Thoothukudi at the campus to save energy.

We are pleased to mention that all the identified energy saving proposals has been discussed with St. Mary's College (Autonomous), Thoothukudi operating and maintenance executives concerned before finalising the ideas.

A discussion on the findings of detailed energy audit at St. Mary's College (Autonomous), Thoothukudi, was presented to the plant personnel on 21st August 2018.The contents of the report are based on the data provided by St. Mary's College (Autonomous), Thoothukudi, during the detailed energy audit.

CHAPTER II

LIST OF ENERGY SAVING PROPOSALS

Sl No	Energy Saving Proposals	Annual Savings (Rs,)	Investment (Rs.)	Payback (Period In Months)
1	Replace Conventional Tube Lights with Energy Efficient LED Tube Lights	160000	267000	20
2	Replace GLS Night Lamps with LED Night Lamps for Indication Applications	10000	1200	2
3	Switch off Offline UPS Systems, While closing the Laboratory	37000	-	-
4	Remove Stabilizer for Inverter Based Refrigerators	3000	-	-
	Total	**210000**	**268200**	**15**

CHAPTER III

ENERGY CONSUMPTION PATTERN

Summary of Energy Consumption

St. Mary's College (Autonomous), Thoothukudi availed 8 Nos. of Low Tension Power Supply from Tamilnadu Electricity Board for their Energy requirements. The Energy Consumption for the last 12 Months are highlighted in the following table :

Service Connection No. 13 College Main Supply

Connected Load – 43.49KW **Tariff : LM2B1**

Month & Year	Units Consumption (kWhr)	Total Bill Amount (Rs.)	Actual Demand (kW)	Power Factor Penalty	Energy Cost per Unit (Rs./kWhr)
August & September 2017	11570	75278	34.16	0	6.51
October & November 2017	9840	64869	29.54	0	6.59
December 2017 & January 2018	7920	53271	28.68	0	6.73
February & March 2018	11390	74275	37.18	0	6.52
April & May 2018	7340	49667	11.52	0	6.76
June & July 2018	9880	65123	31.84	0	6.59
Annual	57940	382483			6.60

The College Energy bill was analyzed on the aspect of minimizing the penalty for excess demand and for low Power Factor.In all the LT Power Supply the penalty for Low power factor is Nil. There are few incidences there is a penalty for excess demand. Hope the proposed implementation of the Energy Saving project will bring the demand under control in the near future.

Service Connection No. 9 Dollarosa Building

Connected Load – 36.49KW **Tariff : LM2B1**

Month & Year	Units Consumption (kWhr)	Total Bill Amount (Rs.)	Actual Demand (kW)	Power Factor Penalty	Energy Cost per Unit (Rs./kWhr)
August & September 2017	2140	17457	26.25	0	8.16
October & November 2017	1850	15741	21.13	0	8.51
December 2017 & January 2018	1410	13091	22.26	0	9.28
February & March 2018	1650	14534	21.02	0	8.81
April & May 2018	2280	18559	36.73	0	8.14
June & July 2018	1650	14594	31.82	0	8.84
Annual	10980	93976			8.56

Service Connection No. 851 Computer Science Block

Connected Load – 25.5KW **Tariff : LM2B1**

Month & Year	Units Consumption (kWhr)	Total Bill Amount (Rs.)	Actual Demand (kW)	Power Factor Penalty	Energy Cost per Unit (Rs./kWhr)
August & September 2017	3280	22970	17.88	0	7.00
October & November 2017	1750	13782	15.66	0	7.88
December 2017 & January 2018	1950	14977	13.80	0	7.68
February & March 2018	2680	19397	16.00	0	7.24
April & May 2018	1070	9616	5.22	0	8.99
June & July 2018	2700	19517	15.24	0	7.23
Annual	13430	100259			7.47

Service Connection No. 953 Controller Office

Connected Load – 6.52 KW **Tariff : LM2B1**

Month & Year	Units Consumption (kWhr)	Total Bill Amount (Rs.)	Actual Demand (kW)	Power Factor Penalty	Energy Cost per Unit (Rs./kWhr)
August & September 2017	1120	7581	6.14	0	6.77
October & November 2017	1140	7765	6.24	0	6.81
December 2017 & January 2018	510	3955	5.30	0	7.75
February & March 2018	920	6431	5.34	0	6.99
April & May 2018	1210	8263	7.02	0	6.83
June & July 2018	1000	6920	6.24	0	6.92
Annual	5900	40915			6.93

Service Connection No. 1000 Self Supported Course

Connected Load – 11.15KW **Tariff : LM2B2**

Month & Year	Units Consumption (kWhr)	Total Bill Amount (Rs.)	Actual Demand (kW)	Power Factor Penalty	Energy Cost per Unit (Rs./kWhr)
August & September 2017	2470	20947	11.15	0	8.48
October & November 2017	1760	15343	10.38	0	8.72
December 2017 & January 2018	1610	10883	8.62	0	6.76
February & March 2018	2240	19320	11.89	0	8.63
April & May 2018	770	7516	1.07	0	9.76
June & July 2018	1940	16784	10.63	0	8.65
Annual	10790	90793			8.41

Service Connection No. 770 Self Supporting Course

Connected Load – 9.74KW **Tariff : LM51**

Month & Year	Units Consumption (kWhr)	Total Bill Amount (Rs.)	Actual Demand (kW)	Power Factor Penalty	Energy Cost per Unit (Rs./kWhr)
August & September 2017	1500	14086	6.18	0	9.39
October & November 2017	1200	11599	7.16	0	9.67
December 2017 & January 2018	1000	9902	6.18	0	9.90
February & March 2018	1070	10469	5.16	0	9.78
April & May 2018	690	7274	5.78	0	10.54
June & July 2018	1270	12177	5.36	0	9.59
Annual	6730	65507			9.73

Service Connection No. 10 Hostel

Connected Load – 21KW **Tariff : LM2B1**

Month & Year	Units Consumption (kWhr)	Total Bill Amount (Rs.)	Actual Demand (kW)	Power Factor Penalty	Energy Cost per Unit (Rs./kWhr)
August & September 2017	3770	25329	7.86	0	6.72
October & November 2017	3000	20687	8.16	0	6.90
December 2017 & January 2018	2620	18392	8.34	0	7.02
February & March 2018	3150	21598	9.14	0	6.86
April & May 2018	1330	10604	8.24	0	7.97
June & July 2018	2810	19533	7.90	0	6.95
Annual	16680	116143			6.96

Service Connection No. 12 Hostel

Connected Load – 15KW Tariff : LM51

Month & Year	Units Consumption (kWhr)	Total Bill Amount (Rs.)	Actual Demand (kW)	Power Factor Penalty	Energy Cost per Unit (Rs./kWhr)
August & September 2017	4560	40704	8.62	0	8.93
October & November 2017	2620	24309	8.52	0	9.28
December 2017 & January 2018	2380	22252	4.72	0	9.35
February & March 2018	2830	26063	5.68	0	9.21
April & May 2018	1970	18793	5.80	0	9.54
June & July 2018	2700	24971	6.16	0	9.25
Annual	17060	157092			9.21

The Maximum Demand availed for the Hostel LT Service No. 10 & 12 is utilized 50%. It is recommended to add additional load only to this LT Service connection to minimize the demand cost. The future load may be connected in this service till its reaches the availed Maximum Demand.

ENERGY CONSERVATION SCENARIO AND ENERGY SAVING MEASURES IMPLEMENTED

St. Mary's College (Autonomous), Thoothukudi, have performed well on the Energy conservation (ENCON) front. Many energy saving projects have been implemented.

TCE Energy Team analyzes the Energy Consumption pattern of all the LT Power Supply System on the aspect of variation of consumption with respect to college working days and vacation and found reasonable. TCE appreciates

the excellent efforts of St. Mary's College (Autonomous), Thoothukudi team towards energy conservation and their achievements. St. Mary's College (Autonomous), Thoothukudi is one of the lowest energy consuming college among the arts colleges of equivalent strength, we have come across.

Summary of Annual Energy Consumption in the LT Power Supply in the Campus

LT Service No.	Tariff	Annual Units Consumption in Kwh	Annual Bill Amount in Rupees	Contracted Demand in KW	Actual Demand in KW	Energy Cost per Unit
13 College Main Supply	LM2B1	57940	382483	43.49	37.18	6.60
9 Dollarosa Building	LM2B1	10980	93976	36.49	36.73	8.56
851 Computer Science Block	LM2B1	13430	100259	25.5	17.88	7.47
953 COE	LM2B1	5900	40915	6.52	7.02	6.93
1000 Self Supporting Course	LM2B2	10790	90793	11.15	11.89	8.41
770 – Self Supporting Course	LM51	6730	65507	9.74	7.16	9.73
10-Hostel	LM2B1	16680	116143	21.00	9.14	6.96
12 – Hostel	LM51	17060	157092	15.00	8.62	9.21
Overall		139510	1047168	168.89	135.62	7.51

Some of the important energy saving projects already implemented by St. Mary's College (Autonomous), Thoothukudi are as follows :

- Installation of 12Nos. of Solar PV Based Street Lighting System
- Use of Energy Efficient LED Tube Lights in few locations
- Efficient use of Sunlight for Day lighting purpose

- User awareness on Energy Conservation practices.

St. Mary’s College (Autonomous), Thoothukudi has a very good committed technical team. We feel that the concerted efforts of the committed plant personnel will help to realize the vision of being the Model energy efficient College in the country.

ENERGY SAVING PROPOSAL NO. 1

Replace Conventional Tube Light With Energy Efficient LED Tube Light

Background

The Conventional Tube Lights consume power 50 to 54 Watts. The breakup of power consumption in conventional Tube Light are 40Watts for Tube Light and 10 to 14Watts for the inherent iron losses and copper losses in the Choke. The Energy Efficient LED Tube Light consumes only 18 to 22Watts and produce same light levels.

The comparison of power consumption for conventional tube light and the energy efficient LED Tube Light is given below:

Power Consumption	Conventional Tube Light	Energy Efficient LED Tube Light
Tube light	40 Watts	20 Watts
Choke Loss	10 Watts	Nil
Saving in Watts		30 Watts

Recommendation

We recommend replacing the Conventional Tube Light with choke set with Energy efficient LED Tube Light in a phased manner.

We strongly recommend buying Philips Brand LED Tube lights for Quality and Reliability.

Benefits

The estimated annual savings is **Rs.1,60,000/-** with an investment of **Rs.2,67,000/-**, which will get paid back in **20** months.

The Breakup for Energy Saving opportunities with LED Tubelight

Locations	Tubelight Operating Hours	No. Of Days	No. Of Tubelight	Energy Cost Saving Potential in Rupees	Investment in Rupees	Payback Period in Months
Outdoor Security Lighting	12 Hours	365 Days	24 Nos.	22000	12000	7
Main Office	8 Hours	220 Days	140 Nos.	51000	70000	17
Computer Laboratory & Staff Rooms	6 Hours	220 Days	214 Nos.	59000	107000	22
Classrooms & Laboratory	4 Hours	220 Days	156 Nos.	28000	78000	33
No. Of Tubelight in College Campus			534 Nos.	160000	267000	20

We recommend replacing the Conventional Tubelight with LED Tubelight, on top priority, where the No. of burning hours is more. Whenever the burning hours is less, the replacement may be done based on the failure basis.

Summary of the Energy Cost saving and Payback period for different Hours and Days of operation for the LED Tube light Fittings:

Area	Hours of Operation Daily	No. Of Days in Operation	Annual Cost Saving	Payback period
Outdoor Security Lighting	12 Hours	365 Days	Rs. 920	7 Months
Main Office	8 Hours	220 Days	Rs. 370	17 Months
Computer Laboratory & Staff Rooms	6 Hours	220 Days	Rs. 227	22 Months
Classrooms & Laboratory	4 Hours	220 Days	Rs. 185	33 Months

Sample Calculations to work out the Annual Cost Saving and Payback period:

If a Conventional Tube lights burns for 12Hours daily and operates for 365days for outdoor lighting purpose.

Annual Energy for Conventional Tube light is =50WattsX12HoursX365days

= 219000Wh = 219kWh

Annual Energy Cost for Conventional Tubelight is= 219kWh X Rs.7/kWh

= Rs.1533/-

Annual Energy for LED Tubelight is =20WattsX12Hours X 365days

= 87600Wh = 87.6kWh

Annual Energy Cost for LED Tubelight is = 87.6kWh X Rs.7/kWh

= Rs. 613/-

Saving in Annual Energy Cost with LED Tubelight

= Rs.1533 – Rs.613 = Rs.920/-

Investment required for New LED Tubelight = Rs. 500/-

Payback period in month for the LED Tubelight

=(Investment/EnergySaving)X12

= (Rs.500 / Rs.920) X 12

= 6.52 ≅ 7 Months

If a Conventional Tube lights burns for 8Hours daily and operates for 220days for Office / Hostel lighting purpose.

Annual Energy for Conventional Tube light is=50WattsX 8Hours X 220days

= 88000Wh = 88kWh

Annual Energy Cost for Conventional Tubelight is= 88kWh X Rs.7/kWh

= Rs.616/-

Annual Energy for LED Tubelight is = 20WattsX 8Hours X 220days

= 35200Wh = 35.2kWh

Annual Energy Cost for LED Tubelight is = 35.2kWh X Rs.7/kWh

= Rs. 246/-

Saving in Annual Energy Cost with LED Tubelight

= Rs.616 – Rs. 246 = Rs.370/-

Investment required for New LED Tubelight = Rs. 500/-

Payback period in month for the LED Tubelight

= (Investment/Energy Saving)X12

= (Rs.500 / Rs.370) X 12

= 16.22 ≅ 17 Months

If a Conventional Tube lights burns for 6Hours daily and operates for 220days for Staffroom & Computer Laboratory lighting purpose.

Annual Energy for Conventional Tubelight is = 50WattsX6HoursX 220days
= 66000Wh = 66kWh
Annual Energy Cost for Conventional Tubelight is= 66kWh X Rs.7/kWh
= Rs.462/-

Annual Energy for LED Tubelight is =20WattsX6Hours X 220days
= 26400Wh = 26.4kWh
Annual Energy Cost for LED Tubelight is = 26.4kWh X Rs.7/kWh
= Rs. 185/-

Saving in Annual Energy Cost with LED Tubelight
= Rs.462 – Rs. 185 = Rs.277/-

Investment required for New LED Tubelight = Rs. 500/-

Payback period in month for the LED Tubelight
=(Investment/Energy Saving)X12
= (Rs.500 / Rs.277) X 12
= 21.66 ≅ 22 Months

If a Conventional Tube lights burns for 4Hours daily and operates for 220days for Classroom & Laboratory lighting purpose.

Annual Energy for Conventional Tube light is =50WattsX4HoursX 220days
= 44000Wh = 44kWh
Annual Energy Cost for Conventional Tube light is = 44kWh X Rs.7/kWh
= Rs.308/-

Annual Energy for LED Tube light is =20Watts X 4Hours X 220days

= 17600Wh = 17.6kWh

Annual Energy Cost for LED Tube light is = 17.6kWh X Rs.7/kWh

= Rs. 123/-

Saving in Annual Energy Cost with LED Tube light

= Rs.308 – Rs. 123 = Rs.185/-

Investment required for New LED Tube light= Rs. 500/-

Payback period in month for the LED Tube light

= (Investment / Energy Saving) X 12

= (Rs.500 / Rs.185) X 12

= 32.43 ≅ 33 Months

Tube light Burning 12 Hours Daily for 365days in a year

Location	No. of Tube light
Street light in the Campus	24

Tube light Burning 8 Hours Daily for 220days in a year

Location	No. of Tube light
New Hostel block-38 Rooms	38
Terasa hostel-23 rooms	46
Dining hall	12
44 rooms	44
Total	**140**

Tube light Burning 6 Hours Daily for 220days in a year

Location	No. of Tube light
Deans Office	5
COE	11
Chemistry staff room	5
Room No:125 Staff room	2
Vice principal room	2
Department of Mathematics	1
Department of English	2
Physics staff room/Lab	6
Staff room	4
Msc Botany	4
Botany staff room	5
Staff office	26
Secretary room	0
M.A.History	7
Susainathar Block-I MHRM	2
II MHRM	2
S-241, M.Com-I	2
HRM dept.	1
II-M.Com	2
Room No:102 III History	2
Room No:103 I Physics	2
Room No:203 I B.Sc. Physics	2
Room No:202 II history	2
Room No:203 II B.Com	3
Room No:204 II Physics	2
Room No:205 I Botany	0
Valan Computer Block -I	4
II	4
III	4
IV	4
V	4
VI	1
Room No: 101	1
Room No:102	1
Room No:103	1
Room No:104	1
Room No:105	1
Room No:106	1
III B.SC. Maths	4
II BBA	1

205-II B.Sc. Microbiology	2
203-II B.Sc. Maths	3
Chemistry upstairs-12 rooms	12
Student office	6
Indoor Stadium	30
Computer lab/Internet centre	4
UG Computer lab	20
Computer lab	3
DST-FIST Computer lab	0
Total	**214**

Tube light Burning 4 Hours Daily for 220days in a year

Location	No. of Tube light
Bio Chemistry (PG) lab	10
Chemistry UG lab 1	6
Chemistry UG lab 2	6
Chemistry UG lab 3	1
Physics lab	14
Zoology lab	8
PG-Zoology lab/Library	20
Botany lab	17
Botany instrumentation room	0
Microbiology lab	8
Language lab	3
Madonna Block-Computer lab	2
Botany PG library	8
General Library	43
UG library (History)	4
PG library Commerce	3
Library (M.A.English)	3
Total	**156**

ENERGY SAVING PROPOSAL NO. 2

Replace GLS Night Lamps with LED Night Lamps for Indication Applications

Background

The 15Watts GLS Lamps (Named as Zero Watts Lamp) are commonly used to indicate the availability of Power Supply in LT Service metering rooms. Even though the lamps are called as Zero Watts Lamp, their actual power consumption is 15Watts. The LED Lamps are available in Market for Indication applications are consumes less than 1Watts. The LED Lamps are solid state devices and has better life than the GLS lamps and having a typical life of 100000 operating hours.

Around 12 Locations, the LED lamps are used almost 24hours, especially in LT Service Metering room.

Recommendation

We recommend replacing the 15Watts GLS Lamps with LED Type Lamps in Indication Applications.

We strongly recommend buying Philips Brand Zero Watts LED Indication Lamp for Quality and Reliability.

Benefits

The estimated annual savings is **Rs.10,000/-** with an investment of **Rs.1,200/-**, which will get paid back in **2** months.

Sample Calculations to work out the Annual Cost Saving and Payback period:

If a 12Nos. of Conventional 15Watts Night Lamps burns for 24Hours daily and operates for 365days for Indication purpose.

Annual Energy for 12Nos.of 15Watt Night Lamps is

= 2Nos.X15WattsX24HoursX365days

= 1576800Wh = 1576kWh

Annual Energy Cost for 12Nos. of 15Watt Night Lamp is

= 1576kWh X Rs.7/kWh

= Rs.11032/-

Annual Energy for 12Nos. 1Watt LED Night Lamp is

=12Nos.X1WattX24Hours X 365days

= 105120Wh = 105kWh

Annual Energy Cost for 12Nos. of 1Watt LED Night Lamp is

= 105kWh X Rs.7/kWh

= Rs. 735/-

Saving in Annual Energy Cost with LED Night Lamp

= Rs.11032 – Rs.735 = Rs.10297/-

Investment required for 12Nos. of New LED Night Lamp

= 12Nos. X Rs. 100/- = Rs.1200/-

Payback period in month for the LED Night Lamp

= (Investment/Energy Saving)X12

= (Rs.1200 / Rs.10000) X 12

= 1.44 ≅ 2 Months

ENERGY SAVING PROPOSAL NO. 3

Switch-Off Offline Uninterrupted Power Supply (UPS) Systems While Closing the Laboratory

Background

The Uninterrupted Power Supply (UPS) systems are switched ON always and throughout the year. The major LT Power supply system are provided with Diesel Generator Set (DG) backup and can be started with a maximum delay of 10Minutes. The UPS systems are provided with 15 Minutes to 30 Minutes battery backup.

After laboratory hours the UPS Systems consumes idle / No-load power for its inherent losses. A 3KVA UPS will consumes 150Watts power at no-load. There is a good scope to minimise no-load power consumption by switching OFF of UPS running idle. The Sealed Maintenance Free (SMF) batteries are used in UPS System. This also helps to improve the life of SMF batteries due to regular charging and discharging.

Recommendation

Switch ON UPS systems as and when required. After the college closes, switch off the UPS systems. Avoid idle running of UPS systems. The typical operating hours of UPS System in an year is around 8Hours per Day and 250Days in an year and equivalent to 2000 Hours and Whereas the idle running period is 6760 Hours per year.

Location	Rating	No load power in Watts
Dolorasa Auditorium UPS No.1	3 kVA	170
Dolorasa Auditorium UPS No.2	5 kVA	160
Valan Computer lab UPS No.1	6 kVA	275
Valan Computer lab UPS No.2	6 kVA	190
Total Savings Potential in Watts		795 Watts

Energy Saving potential = 0.795 KiloWatts X 6760 X Rs.7/- = Rs.37619/-

Benefits

The estimated annual savings potential by Switching OFF the UPS is **Rs.37,000/-.**

It is also recommended to Switch-off the COE Office UPS also after College Hours, whenever the Server is kept under shutdown condition.

ENERGY SAVING PROPOSAL NO. 4

Remove Stabilizer for Inverter Based Refrigerators

Background

The Inverter based Refrigerators are relatively more efficient than the Conventional Refrigerators. The latest Inverter based Refrigerators don't requires stabilizers for its operation. The refrigerators' supplier also clearly mentioned that Stabilizer free operation sticker stick on the refrigerators. A typical 500VA Stabilizer will consumes 30 to 430Watts for its inherent losses. Presently two nos. of inverter based refrigerators are used in St. Mary's College, Thoothukudi.

Recommendation

We recommend to connect the Inverter based Refrigerator directly to the Power Supply and uninstall the Stabilizer used. In future needs, we recommend to buy inverter based Air-conditioners and Refrigerators to minimize the power consumption.

Energy Saving potential = 0.06 Kilowatts X 8760 X Rs.7/- = Rs.3679/-

Benefits

The estimated annual savings potential by uninstalling the Stabilizer for Inverter based Refrigerator is **Rs.3,000/-.**

CHAPTER V

METHODOLOGY ADOPTED FOR THE ENERGY AUDIT STUDY

St. Mary's College (Autonomous), Thoothukudi, evinced interest in availing the services of TCE - EMC - Energy Management Cell to conduct Detailed Energy audit. The scope of services for conducting the detailed energy audit at St. Mary's College (Autonomous), Thoothukudi is as follows.

DETAILED ENERGY AUDIT

The Detailed Energy Audit study has covered all types of energy at St. Mary's College (Autonomous), Thoothukudi. Based on our past experience and information provided by St. Mary's College (Autonomous), Thoothukudi. The following areas are looked into detail for energy saving opportunities.

ELECTRICAL DISTRIBUTION SYSTEM

During the Detailed Energy Audit, Electrical Distribution System has been studied in the following aspects:

- To reduce distribution and cable losses
- To reduce transformer loss
- Sufficiency of capacitors
- Performance of capacitors etc.

LIGHTING SYSTEM

TCE - EMC has studied the lighting system at St. Mary's College (Autonomous), Thoothukudi in the following aspects for energy savings:

- Installation of electrical energy savers in lighting system

- Energy efficient lighting practices
- Modification in lighting system to minimize power consumption

AIR-CONDITIONERS

TCE – EMC has studied the Air-conditioners, which consumes the major portion of power. The Air-conditioners are studied with the following points in mind :

- Deliver Air Temperature
- Return Air Temperature
- Power Consumption & Power Factor

METHODOLOGY OF DETAILED ENERGY AUDIT STUDY

Detailed energy audit has conducted on 20th and 21st August 2018.

St. Mary's College (Autonomous), Thoothukudi management has named Mr. A. Antony Loyala, Laboratory Assistant, as co-ordinator. He has coordinated for all the Data Collection and for measurements.

At the end of the Detailed Energy Audit, all the findings have been discussed with operating, maintenance and senior executives, concerned, for their feedback.

A discussion has been made on 21st August 2018 to the college personnel on the findings of the Detailed Energy Audit study.

Based on the report presented St. Mary's College (Autonomous), Thoothukudi can initiate implementation activities, to reap full benefits.

CHAPTER VII

SCOPE FOR IMPROVEMENT

IMPROVEMENT OPPORTUNITIES

During the Detailed Energy Audit at St. Mary's College (Autonomous), Thoothukudi, TCE team and St. Mary's College team identified some of the possible areas to improve further, Which will gives energy saving but it won't payback within three years of time and also difficult to quantify in some cases. But, it also increases the reliability of the equipment in a great extent.

INSTALL SLEEP MODE FACILITY FOR ALL THE COMPUTER SYSTEM

The computer system running in idle mode consumes 90 – 120Watts of power depending upon the size of the monitor 15" or 19". There is a provision available in the computer system to set the computer to sleep mode. In the sleep mode of operation the monitor power consumption is nil & system will consume a little bit of power to restore the earlier status.

The recommended times to set for the sleep mode for various devices in Computer System are as follows:

- Monitor will go to Sleep mode if the System is idle for 5 Minutes.
- Hard disk will go to Sleep mode if the System is idle for 10 Minutes.
- Processor will go to Sleep mode if the System is Idle for 15 Minutes.

This needs to be done in all Computer Systems in the Campus by the Computer Laboratory Technicians and reviewed regularly on monthly basis to verify the practice is continuing or Not.

Recommendation:

It is strongly recommended to implement the sleep mode facility to minimize the power consumption in Computer Systems.

Note : The screen saver mode of operation only saves the life of screen, but the sleep mode saves the power & life of screen.

INSTALL COMMON UPS INSTEAD OF STANDALONE 0.5KVA UPS IN LABORATORY

Background

The Standalone 0.5KVA UPS systems are used in Computer Laboratory No.2 at Madonna Building and College Main office. Whenever more than 10Nos. of Computer Systems are installed in a location, it is recommended to install common UPS System to minimize the losses. The no-load power consumption of 0.5KVA UPS is around 30 to 40Watts, whereas for a 3KVA UPS Systems is around 170Watts. The reliability of 3KVA UPS System is relative more than the 0.5KVA UPS System.

Recommendation

We recommend replacing 0.5KVA standalone UPS Systems with 3KVA Group UPS systems to minimize the power consumption.

PURCHASE OF BLDC FAN FOR NEW INSTALLATION

Presently conventional single phase induction motor based Ceiling fans are commonly used for ventilation in Classrooms, Laboratory and Staff rooms. The conventional ceiling fan consumes 65Watts, whereas the BLDC type Ceiling fan consumes 35Watts for the same sweep area. There is a potential to save 30Watts power per ceiling fan, if the conventional ceiling fan is replaced with BLDC type ceiling fan. The annual energy cost saving per ceiling fan if the fan is running for 6Hours per day and for 220Days in an year around Rs. 280/- per

Ceiling fan. The price of BLDC fan is around Rs.3000/- to Rs.3500/-. The typical payback period for the college is around 10 Years.

Whenever, St. Mary's College plan to buy ceiling fans for new building or expansion or modernization activities, it is recommended to buy BLDC fan. St. Mary's College also replace the old ceiling fans with the BLDC ceiling fans, whenever any major repair works raises in the old Ceiling Fans.

This BLDC fan can be preferred for more than 6hrs functional areas like hostel rooms, which will reduce the payback period.

MARKING OF SWITCH CONTROL FOR LIGHTS and FANS

Presently in Laboratories the students find difficulties to identify the switch for a tube light / fan. Hence, their tendency is switch ON all the switches and do the works even few Lights and Fans are not required in the Laboratories.

Number the Light, Fan & Air conditioner and Marking should be done on Switch point as well as near the Tube light, Fan & Air conditioners in laboratories. This will helpful to the students to switch ON the required Tube light and Fan.

REPLACE OLD CRT MONITOR WITH LED MONITOR FOR COMPUTER SYSTEM

The old CRT Type monitor will consume power of 65 to 90Watts, whereas the latest LED Monitor consumes only 50Watts. There are 3Nos. of CRT monitors used in computer laboratory at Dollorosa Building of St. Mary's College. We

recommend replacing the old CRT Monitor with LED Monitor for Computer System.

INSTALL PEDESTAL FAN & AVOID USE OF AIR-CONDITIONERS DURING NON-LABORATORY HOURS

During Regular laboratory class hours, the no. of students inside the laboratory is around 25 to 50. The air-conditioners are designed to cool and maintain the temperature & humidity for comfort during Regular laboratory class hours. But non-laboratory class hours, the no. of persons working in the computer laboratory is very few. During this period, there is a good scope to reduce energy consumption by using pedestal fan and avoiding use of air-conditioners.

SUBMERSIBLE PUMPS TO REPLACE THE MONOBLOCK PUMPS FOR WATER PUMPING

The monoblock pumps are used for pumping of water from the sump to overhead tank. The suction heads is zero for Submersible water pumps and more efficient than the monoblock pumps. It is recommended to replace the Monoblock pumps with Submersible pumps, whenever the old pumps fails. Rewinding of the old pumps may be avoided and the failed pump may be replaced with submersible water pump.

INSULATION REPLACEMENT IN DOLLOROSA BUILDING CENTRAL AIR-CONDITIONING SYSTEM

In Dollarosa Building, Centralized Air-conditioning has been installed for air-conditioning the Auditorium. The insulation provided for the refrigerant handling pipeline was in failed condition due to ageing. This leads to loss of chillness to the ambient and results in excess power consumption in the Air-conditioners. It

is recommended to revamp the thermal insulation for the pipelines to minimize the power consumption in the air-conditioners.

WATER OVERFLOW CONTROL

During the Detailed Energy Audit studies, the TCE Energy Team observed, water overflow in the College Main Building Block. It is recommended to install water overflow controllers or depute the technician only for pump operation for a particular time slot and allot the other work after water pumping work is over.

SAFETY AND OTHER IMPROVEMENT OPPORTUNITIES

During the Detailed Energy Audit, the TCE Energy Team observed Temporary wiring in few locations. This needs to be made permanent to increase the safety.

The TCE Energy Team recommends replacing the old Fuse Distribution system with MCB Distribution board for better protection from faults and to improve the safety.
Unused / Faulty Equipment and materials are stored in UPS Rooms and EB Metering rooms need to be disposed with proper permission and approval from the authorities.

Few locations, the trees are touching the building, which needs to be trimmed to avoid false lightning entry to the building. This may results in building cracks.

The Thermal imaging study carried out by the TCE Team identified loose connection in the Power Distribution System of Service Connection No. 13. This can be rectified by re-termination of Wires and Cables. This distribution board may be replaced with the modern MCCB Distribution board system.

CHAPTER - VII

MANAGEMENT ASPECTS & CONCLUSIONS

THE OBJECTIVES OF St. Mary's College (Autonomous), Thoothukudi, SHOULD BE

- Make Energy conservation a permanent activity at St. Mary's College (Autonomous), Thoothukudi.
- To achieve lowest energy cost without compromising quality of Educational Services
- One of the best Energy Efficient Colleges in India
- To achieve this objective, a firm top management commitment is required at the highest level that the company wants to conserve energy on a time bound basis.
- The top priority is to implement the recommended proposals and reap benefits.

APPROACH TO AN ENERGY CONSERVATION IDEA

Each energy conservation idea should be seen as an opportunity for improvement. The approach must be on how to implement each proposal and overcome the problems, if any.

It is easier to say a proposal is not possible or not implementable but the benefit comes from the actual implementation, which needs lot of courage, conviction, will power and perseverance to implement.

SPECIFIC RECOMMENDATION

St. Mary's College (Autonomous), Thoothukudi, should form an energy conservation committee. The committee should consist of senior operating and maintenance personnel.

The committee should meet once in a month with a specific agenda to review the progress of implementation of proposals and to guide the implementation team. St. Mary's College, Thoothukudi, should also select a senior person, as energy manager and he should coordinate all implementation activities.

The main responsibility of implementing the proposals and achievement of savings should be with the concerned operating and maintenance personnel and not with the energy manager.

The immediate task of St. Mary's College (Autonomous), Thoothukudi, should be to implement the identified proposals and get the savings.

We would recommend St. Mary's College (Autonomous), Thoothukudi, to introduce a suggestion scheme for energy conservation. The energy conservation committee should review all suggestions and good proposals should be implemented. The originator for the good suggestion, which has been successfully implemented, has to be rewarded.

ASSIGN SPECIFIC RESPONSIBILITY

While the overall responsibility for energy conservation rests with the top management, the concerned plant operates / maintenance personnel should implement and report progress on energy saving proposals.

Therefore, each energy saving proposal should be assigned to a specific operating / maintenance personnel for implementation and monitoring.

Specific time bound action plan is required for implementation and monitoring of energy saving proposals.

CONCLUSIONS

- TCE energy audit team and St. Mary's College (Autonomous), Thoothukudi, energy team and have jointly identified proposals for implementation.
- An annual savings potential of **Rs.210000/-** can be realised by implementing the recommended proposals
- Out of the total Annual savings identified **Rs. 40000/-** can be achieved without any investment.
- The savings of **Rs. 170000/-** can be achieved with an investment of **Rs 268200**, which will be paid back in **15** months.
- Implementation of identified proposals should be given top priority and should be done step-by-step.

St. Mary's College (Autonomous), Thoothukudi, SHOULD :

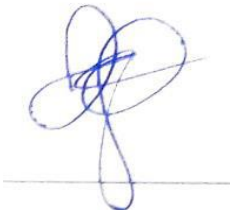
- Assign specific responsibility for implementation of proposals
- Monitor savings achieved proposal by proposal
- Monitor overall Energy Consumption in each LT Supply availed – area wise
- St. Mary's College (Autonomous), Thoothukudi should have the goal of becoming the best energy efficient College in India

ANNEXURE – A

DETAILS OF LOW TENSION SERVICES

Name of the LT Consumer	: St. Mary's College, Thoothukudi
Service Connection No.	: 9,10,12,13,770,851,953 &1000
Sanctioned Maximum Demand	: 168.89 Kilowatts
Classification of Industry	: Institution Building
Nature of Products Manufactured	: Service
Name of the Product Manufactured	: Service
Full Postal address with Phone No.	: ECR Road (SH-43), Cruz Puram Thoothukudi Pin code – 628 001. Phone No. 0461 232 0946 Fax No. 0461 232 0947
Private / Public Sector	: Government Aided
Specific Energy Consumption	: Not Applicable
Energy Audit Organization	: Energy Management Cell Thiagarajar College of Engineering, Madurai – 625 015

Team of Engineers conducted Energy Audit studies

Sl.No	Name of the Person	Discipline	Signature
1.	Dr.V.Saravanan	Associate Professor in Electrical & Electronics Engineering	
2.	Dr.D.Nelson Jayakumar	Approved Energy Auditor by BEE / Assistant Professor in Electrical & Electronics Engineering	
3.	Dr.P.S.Manoharan	Associate Professor in Electrical & Electronics Engineering	

Details of Energy Audit Study

Date of Commencement of Detailed energy Audit Study : 21st August 2018

Date of Completion of Detailed energy Audit Study : 22nd August 2018

Date of Submission of Three copies of Detailed Energy Audit Reports to the consumer : 17th September 2018